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Remarks on the Stowage and Sailing of Ships and Vessels. By Commander John Pearse, R. N.

The following remarks have sprung from ideas formed during and after a practical experience, as a seaman, of upwards of twenty years' active sea service. I commit them to paper as a seaman; and solely with the intention of endeavouring to show, by a plain statement, what appear to me as errors in the system of stowing and sailing our ships. Perhaps I may venture to assert, that, generally speaking, there is no regular system followed, or that the subject is not sufficiently considered on mathematical principles.

Chapman, in the preface to his *Treatise on Ship Building*, observes, that, "in the construction of ships, people usually make attempts, at different times, to improve the form, each person according to his own experience; thus, after the construction of one ship, which has been tried and found to possess such or such a bad quality, it seems possible to remedy this defect in another. But it often (not to say generally,) happens, that the new ship possesses some fault equally as great, and, frequently, even that the former defect, instead of being removed, is increased. And we are unable to determine whether this fault proceeds from the form of the ship, or from other unknown circumstances.

It thus appears, that the construction of a ship with more or less good qualities, is a matter of chance, and not of previous design. And it hence follows, that as long as we are without a good theory on ship building, and have nothing to trust to beyond bare experi-

ments and trials, this art cannot be expected to acquire any greater perfection than it possesses at present.

"At the same time, the construction of ships and their equipment are attended with too great expense, not to endeavour, beforehand, to ensure their good qualities, and their suitableness for what they are intended for. The theory then which elucidates the causes of their different qualities, which determines whether the defects of a ship proceed from its form, or from other causes, is truly important; but as the theory is unlimited, practice must determine its limits. We may, consequently, further conclude, that the art of ship building can never be carried to the last degree of perfection, nor all possible good qualities be given to ships, before we at the same time possess, in the most perfect degree possible, a knowledge both of the theory and practice.

"Lastly, it is evident, from all that has been said, that a ship of the best form will not show its good qualities, except it is at the same time well rigged, well stowed, and well worked by those who command it."

I have quoted the authority of Chapman, to show that much depends on the stowage and management of a ship.

Many experiments have, of late years, been tried, many improvements made, and much, no doubt, yet remains to be done. But although naval architects appear still to differ respecting the formation of the body, it appears to me there is less room for improvement in the structure, than in the system of stowage and sailing, which appears to require considerable alteration, before it can reach perfection.

It has been very generally observed how well our own ships, after an action, and those captured from the enemy, have appeared to sail under jury-masts, or, comparatively speaking, they have appeared to sail better in proportion under jury-masts, than with their proper ones—a strong proof in support of which occurred a few years since.

The Essex, late American frigate, sailed from Plymouth, under very low jury-masts, attended by the Dwarf cutter, of two hundred and ten tons, for Dublin, there to remain as a depot. At the entrance of the Bristol Channel, they fell in with a large smuggling lugger, to which they gave chace off the wind; the Essex, after a considerable run, capturing the lugger, and leaving the Dwarf out of sight, or nearly so—a proof she must have sailed as fast as if properly masted.

I shall mention one more circumstance. It will be recollected, the Vanguard, lord Nelson's flag-ship, lost her fore-mast off Toulon, previous to his fleet joining him, and his pursuit of the French fleet to Egypt. His lordship proceeded in the Vanguard, under a jury fore-mast, to Egypt, back to Sicily, and to Egypt again, where he found the enemy; and I do not recollect the Vanguard causing the least delay or impediment to the fleet. Had his lordship considered it likely, or that the Vanguard would not have been able to keep her station in chase, in the event of falling in with the enemy at sea, he would, no doubt, have shifted his flag to some other ship; and the

world knows well his lordship was too anxious to be first in action to risk any thing that might disappoint him.

From these and similar circumstances, an opinion that many of our ships are overmasted, may have partly originated.

Ships are supposed to be constructed agreeable to plans mathematically arranged, varying in their formation according to the ideas of different architects, and intended to be immersed to a certain depth in the water, when complete and ready for sea. To which floatation, it appears to me, they should be brought to, and kept as near as possible, except there should be any material deviation in a ship from the plan about the load water-line; in that case it is better, and as a general thing it is as well, to observe the formation of the bottom about the load water-line; and be guided accordingly.

If a ship is built strictly agreeable to the plan, and is immersed deeper than the builder intends, his views are frustrated, and the object of constructing a ship adapted for fast sailing lost sight of.

Professor Inman, in his general remarks on the construction of ships of war, observes,—

"It may be observed, generally, that it is advantageous to give the projected ship the requisite stability with as little ballast as possible, by which means a constructor is enabled to reduce the displacement or magnitude of the body under water, a circumstance very favourable to a ship in sailing and working. With a similar view, every weight put on board, and reckoned in getting the displacement, should be kept as low as possible. No useless baggage or weight of any kind should be put on board on any account whatever."

I have quoted the above authority as bearing a little on the point, and in corroboration of what I allege.

I must also observe, that, by too deep an immersion, the fullest part of the body would be carried below the surface; consequently, the displacement would be considerably increased, and also the resistance of the water on the lower part of the bottom. It, therefore, appears to me, when a ship, immersed to a certain depth, has not sufficient stability under sail, that the masts should be reduced, in preference to immersing it deeper in the water.

That it is most natural a ship should have masts in proportion to the body, below the surface, when immersed to what is considered a proper depth, must appear very evident; and also that, with such masts, she would sail equally well, as with a deeper immersion and proportional addition to the masts. But it must be expected the ship would be more uneasy under the increased masts in bad weather; and as the masts and rigging may be considered as back sail on a wind, the increased masts and rigging must also add to the impediment of her sailing. Consequently, the advantage must evidently appear in favour of the lesser masts and immersion.

The case of the Essex must appear as strong proof in favour of the principle in sailing off the wind; being, no doubt, ballasted in proportion to her masts. At the same time, it must be allowed no just conclusion could have been derived from a trial of her on a

wind; as on that point, although the sail might be considered in fair proportion to the body immersed, yet, from the body floating high above the surface, the resistance of the wind on it would have been much greater than with a deeper immersion and masts in proportion. Neither would the immersion have been sufficient to resist the lateral impulse.

Chapman, in his *Treatise on Ship Building*, observes, that, "to determine the surface proper to be given to the sails, from the knowledge which we have of the effect of the wind on planes or sails, with different velocities in different directions, it would be necessary to enter upon long calculations of great difficulty, and yet of little importance. We may compare plans of ships, and of their rigging, which are tried and known, and nothing will be required further than to be guided by those ships which have the best proportion of canvass, with respect to the centre of effort of the wind on the sails and the stability."

And professor Inman, in his general remarks on the construction of ships of war, observes, that, "after all the pains the constructor may take, from the imperfection of the theory of resistances, or from some other unknown causes, it is possible that a ship, on going to sea, will not be found to have the point of sail exactly adjusted to the mean resistance. In this case, nothing can be done, except by altering the masting, for effecting which, if possible, every practical facility should, in the first place, be left in the building, or by bringing the ship more by the head or stern; thus adjusting the seat of the ship in the water to the masting, as it is."

By which it appears there is no rule which can be strictly depended on, to calculate a correct proportion for the masts or their positions.

Many of our ships of the same class and computed tonnage, differ in the formation of their bottoms; it also frequently happens that one ship shows greater stability under sail than another; and that, with the same quantity of provisions and stores, one is deeper immersed in the water than another. The only supposition to be drawn from it, is, that they have the same proportion of masts and ballast.

If the supposition be admitted, it appears to me very erroneous, and that ships, though of the same computed tonnage, differing in the formation of their bottoms, ought not, as an established rule, to have the same proportion of masts and ballast.

If one has less displacement than another, she will have less capacity in the hold; consequently, will not stow so much, or require so great a weight to immerse her so deep in the water. It, therefore, appears most natural she should have a less proportion of masts.

As well as what Chapman and professor Inman observe, respecting the proportions for, and positions of, the masts, it may be supposed, from the many alterations which have been made in the masts of our experimental ships, there is no rule to be depended on. And as Chapman observes, "we may compare plans of ships and of their rigging, &c.," which I have quoted before.

That such would be the most correct method to ascertain a true

proportion, there can be little doubt; but it appears to me no just conclusion can be made as to the proper proportion of masts, till the system of stowage has undergone considerable alterations.

I have ventured to assert that, generally speaking, there is no regular system followed in stowing our ships. In proof of which, I think it is only necessary to recollect the many alterations in the stowage of our experimental ships, and the various alterations in the trim of them at sea, and which appear to have made considerable alterations in their sailing qualities.

It is a very common practice to trim ships, by making each man carry a shot or two aft; removing the foremost guns aft, and which is frequently done to ease a ship in a head sea. But it should be recollected when a ship is in chase, the foremost guns are those generally first wanted, and require to be in their places, and the men frequently required in their stations. It must, therefore, appear evident, that but few of our ships are properly stowed; and that it is most essential an attempt should be made to improve the system, to obviate the necessity of such alterations at sea, by a better arrangement of the ballast, stores, and provisions.

I am of opinion that perfection in the stowage should be made a primary object; when that is attained, there will be a sure foundation to work from, in finding a true proportion for the masts. It appears to me perfectly easy, and I hope to see it reduced to a regular and perfect system.

I am also of opinion that, after viewing the formation of a vessel's bottom, very little consideration is required to determine how she ought to be stowed. Naval architects recommend the weight to be kept as near the centre as possible; to me the formation of the bottom points it out, and that the extremities should be kept as light as possible, to ease the pitching and sending motion in a head sea. That all has not been done to effect that object, and which appears to me easily may, I shall endeavour to explain.

Much cannot be said, and very little need be, as to the most proper place for stowing the ballast alone, or its arrangement: it is the distribution of the other weights which can most contribute to it; and the great weights, at present in the fore extremity, stand opposed to it.

A fact well worthy of notice may be introduced here:—

It is universally known how well the Kentish and Sussex smuggling vessels have always sailed. The fact is, there is very little but the cargo to stow, and that is placed in the centre of the vessel. A small quantity of provisions, a few sails, and their anchors and cables, is the only weight beside, and which is also kept clear of the extremities. And this method appears to be derived more from a sort of established knowledge or practice, which descends from father to son, than an acquired system, as perhaps there are no men possessed of less scientific knowledge.

I shall, therefore, only observe, with respect to the ballast, that it should be winged in proportion to the supposed or ascertained inclination of the ship to rolling, and on no account to extend it to the

finer parts; as without it, there is sufficient longitudinal space in a large ship to trim the ballast, so as to bring her to a proper draught of water, provided the stores and provisions are also properly arranged, and those of the least weight selected for stowing nearest the extremities. To contribute towards which, I propose removing the cat-heads, and stowing the anchors further aft; which may be effected, in my opinion, with little or no difficulty.

Viewing it on lever principle, the weight is now at the very extreme end, and the lever in the position "horizontal" of its greatest power.

Chapman observes, "the reason of the pitching and sending motion is easily seen. When a wave has passed the fore-part of the ship, and is got near the middle, there is a great void space under the bows, where the ship is not supported. It precipitates itself, therefore, with a certain momentum, which is the product of the weights in the fore-part, multiplied by their distance from the point where the ship is sufficiently supported.

"This kind of motion is greater in ships which are very full near the load-water-line, fore and aft, and very lean below; but if the weights in the fore-part are carried nearer the middle, the momentum with which the ship plunges itself in this part, will be less; and not only this motion becomes less quick, but, moreover, the following waves which meet the fore-part of the ship, have less difficulty in raising it again. The same observation may be made on the aft-part."

The preceding observations ought to be sufficient to convince all but the most prejudiced, that I am justified in what I propose; and naval architects must concur with me in its utility, although they have never put it in practice. I shall, therefore, endeavour to show that it is practicable.

By removing the cat-heads aft, there would be a few fathoms more of cat-fall to run up, but which, considering the very short time taken to cat the anchor, does not appear to me can be considered an objection: and the anchors being brought abaft the round of the bow, would fish clearer of the side than at present, and stow neater, and similar to the spare and sheet anchors.

From observations which I have made on several frigates, it appears to me, if the cat-heads were removed to the fore-part of the channels, which, in the several ships, would be from eight to ten feet further aft than where now placed, that both stock and fluke would stow perfectly clear of the ports. And when it is considered that a forty-six gun frigate's two bower anchors weigh four tons and a half, which, together with the stocks, cat-heads, knees, fastenings, &c., cannot be estimated at less than six or seven tons, there can be no doubt the removal aft of so much weight would give considerable relief to a ship in a head sea; contribute to a better arrangement in stowing the ship, and, in many cases, obviate the necessity of stowing ballast too near the after extremity. It would also be removing fifty per cent. more weight than the two foremost guns.

There are no vessels which require easing in a sea more than our

brigs. The weight of an eighteen gun brig's two bower anchors, stocks, cat-heads, knees, fastenings, &c., cannot be estimated at much less than four tons; and which, by a little alteration in the arrangement of the chain-plates, to admit the fluke of the anchor in between two shrouds, I am of opinion may be removed aft seven or eight feet, and the anchors stow clear of the ports: as the spare anchor stows clear, which is placed abaft the channels, I can see no reason why the bowers should not.

In cutters I have had the cat-heads so far aft, that the crown of the anchor has stowed close to the fore shroud; they have stowed perfectly easy, and I observed that the copper about the bows has been less injured, than in vessels which had their cat-heads further forward.

It is in our smaller and sharpest vessels its effect would be greatest, but there can be no doubt of its advantage in all ships; and should the experiment be tried, I have no doubt it will be extended to all.

In many ships, and all our smaller vessels, the coal-hole is also very far forward; and as the coals are a considerable weight, and not speedily consumed, I should recommend stowing them further aft, and water where they are now, and to use this water first.

There is also a very great weight in the fore extremity of a line-of-battle ship; the gunner's, boatswain's, and carpenter's stores, which it appears to me may be stowed nearer the centre of the ship, by the following arrangements.

Where those stores are now stowed, to build a room to receive part of the bread from aft, keeping a clear wing passage round the bows, by which means the bread would be as well preserved as if in the after bread-room. The bread forward can be used first, or it can be taken from forward and aft, alternately, as the trim of the ship may appear to require. The remaining space to be divided into store-rooms for marine clothing, slops, beds, and such light weights as are at present stowed in the after cock-pit.

All the mates, midshipmen, and assistant-surgeons, to mess in the gun-room, a much more healthy and airy situation than the cock-pit, and to have a store-room in the cock-pit for the mess-utensils and sea-stores.

By the removal of bread forward, the after bread-room may be considerably reduced, and the surgeon's and purser's cabins removed further aft. By such an arrangement there would be sufficient space abaft the cable-tiers for the reception of the gunner's, boatswain's, and carpenter's stores; and which would not be much abaft the centre of the ship.

In frigates, also, and smaller vessels, similar arrangements should be made as far as possible; and if those were carried into effect, there would be no necessity for extending the stowage of the ballast to the after extremity, as is too often the case.

In the Cruizer, "eighteen gun brig," we were obliged to stow ballast in the bread-room—the case, I believe, in most of the brigs; which would not have been requisite, had the anchors and coal-holes

been removed further aft. Since which, I believe, some alteration has been made in the store-rooms; but if weight has been reduced in the fore extremity, by that means, it has been increased again by the addition of a heavy forecastle, which also considerably increases the top weight. Poops and quarter boats have followed the forecastles; and to the little ten-gun brigs, all this additional top weight has been added—even a cutter of one hundred and twenty tons, follows the rage for carrying quarter boats.

I must repeat an observation of professor Inman's, as it is most applicable to the point in question:—

"It may be observed, generally, that it is advantageous to give the projected ship the requisite stability with as little ballast as possible, by which means a constructor is enabled to reduce the displacement or magnitude of the body under water, a circumstance very favourable to a ship in sailing and working. With a similar view, every weight put on board, and reckoned in getting the displacement, should be kept as low as possible. No useless baggage or weights of any kind should be put on board on any account whatever."

Every one who can agree with professor Inman, must condemn the system of adding so much top and overhanging weight.

Forecastles were first fitted by the captains, were very light, and could not have caused much impediment to the vessel's sailing; but the heavy way they are now fitted, many with heavy bulwarks above them, and other additions which have succeeded, must be materially felt.

I may be told the quarter boats are of a light description; but when every common sailor will admit a jacket hung in the rigging to be an impediment to sailing on a wind, I say it is inconsistent to carry quarter boats in such small vessels. But, allowing them to be of a light description, the weight of the iron davits is to be added, and it should be remembered that when a vessel is launching, although its actual weight is not, yet its power is, considerably increased by the action of the vessel.

I was four years and a half first lieutenant of an eighteen-gun brig; they were then in their original state, and no vessels sailed better. I afterwards commanded a large cutter four years, and had many opportunities of sailing with brigs, in their original state. Subsequent to which I commanded a large cutter three years, and under the orders of several of the finest brigs in their present state; and I am convinced they neither sail nor work so well as formerly, and that it is attributable to the alterations which have been made.

I am also of opinion, that by taking away the poops and quarter boats, building the forecastles as light as possible, with only a low wash-stroke of three-quarter inch elm or oak board above it, which would be quite sufficient, and removing the anchor and coal-holes further aft, they would be superior in their sailing qualities, and as sea boats, to what they were in their original state.

Masts are frequently raked, by some to ease a ship in a head sea, by others to improve her sailing.

It does not, however, occur to me, that it can give much relief to a ship: for, supposing it to be the overhanging weight of the mast, acting on lever principle, which contributes to the pitching motion, the mast must be considerably beyond a perpendicular before it can have much effect; and admitting the supposition, it may naturally be supposed that a raking mast will act diametrically, and increase the sending motion aft.

But there appears to me a great objection to raking masts, in ships and square-rigged vessels.

If masts are raked, the yards are not at right angles with them, when a ship is on a wind. The consequence is, the sails are put out of their proper form, and drawn, or I may say forced, towards a diamond shape. The main-sail shows it in the diagonal girt across the sail from the tack to the lee-earing; the leeches of the sails are quite slack, and bag to leeward.

It is allowed the wind acts on the same principle when striking the sails obliquely, as if perpendicular, or at right angles—its power decreasing as the obliquity increases. If, therefore, the lee leeches of sails are slack, and bag to leeward, the obliquity of the wind must be increased, and its power lessened. It, therefore, appears much preferable to give a ship relief, by removing weight from the fore extremity, than by raking the masts.

I have frequently heard of various alterations having been tried in ships, to improve their sailing, and that raking the masts was the only one which proved successful. This is a circumstance which, it appears to me, may be considered as arising from some of those unknown causes alluded to by professor Inman in the following observation:—

"After all the pains the constructor may take, from the imperfection of the theory of resistances, or from some other unknown causes, it is possible that a ship, on going to sea, will not be found to have the point of sail exactly adjusted to the mean resistance. In this case, nothing can be done except by altering the masting; for effecting which, if possible, every practical facility should, in the first place, be left in the building, or by bringing the ship more by the head or stern, thus adjusting the seat of the ship in the water to the masting as it is."

The circumstance, however, proves an error; but where, it is difficult to determine,—and without being in possession of particulars, it were useless to attempt it. The ships might not have had their proper seats in the water; the point of sail might not be correctly adjusted, or it might arise from some other cause.

It is evident, however, that, seated in the water as they were, they required more after-sail—consequently could not have steered well; and it generally happens when a ship steers badly she does not sail well. The conclusion, therefore, may very naturally be, that raking the masts improved both steering and sailing qualities.

It, however, appears to me, when a ship is properly seated in the water, and requires more after-sail, that it is preferable to remove the foremast a little further aft than to rake the masts, as it would

have the same effect, and give considerable relief to the fore extremity.

There is one part of professor Inman's observation—"or by bringing the ship more by the head or stern, thus adjusting the seat of the ship in the water to the masting, as it is," which it appears to me can only be meant as a temporary expedient, and till an opportunity offers to alter the masting; as it would be sacrificing a very material point—the proper seat of the ship in the water. J. P.

[*Quarterly Journal.*

On the Phenomena of Volcanoes. *By* Sir Humphry Davy, Bart. F.R.S.*

When in the years 1807 and 1808, I discovered that the alkalies and the earths were composed of inflammable matter united to oxygen, a number of inquiries suggested themselves with respect to various parts of chemical science, some of which were capable of being immediately assisted by experiment, and others required for their solution a long series of observations, and circumstances obtained only with difficulty. Of the last kind were the inferences concerning the geological appearances connected with these discoveries.

The metals of the alkalies, and those of such of the earths as I had decomposed, were found to be highly combustible, and altered by air and water even at the usual temperatures of the atmosphere; it was not possible, consequently, that they should be found at the surface of the globe, but probable that they might exist in the interior: and allowing this hypothesis, it became easy to account for volcanic fires, by exposure of the metals of earths and alkalies to air and water; and to explain, not only the formation of lavas, but likewise that of basalts and many other crystalline rocks, from the slow cooling of the products of combustion or oxidation of the newly-discovered substances.

I developed this opinion in a paper on the decomposition of the earths, published in 1808; and since 1812, I have endeavoured to gain evidence respecting it by examining volcanic phenomena of ancient and recent occurrence in various parts of Europe.

In this communication I shall have the honour of laying before the Royal Society some results of my inquiries. If they do not solve the problem respecting the cause of volcanic fires, they will, I trust, be found to offer some elucidations of the subject, and may serve as the foundation of future labours.

The active volcano on which I have made my observations is Vesuvius; and there probably does not exist another so admirably fitted for the purpose: its vicinity to a great city; the facility with which it may be ascended in every season of the year; and the nature of

* From the Philosophical Transactions, for 1828. Part I.

its activity,—all offer peculiar advantages to the philosophic inquirer.

I had made several observations on Vesuvius in the springs of 1814 and 1815, which I shall refer to on a future occasion in these pages; but it was in December, 1819, and January and February, 1820, that the volcano offered the most favourable opportunity for investigation. On my arrival at Naples, December 4, I found that there had been a small eruption a few days before, and that a stream of lava was flowing with considerable activity from an aperture in the mountain a little below the crater. On the 5th I ascended the mountain, and examined the crater and the stream of lava. The crater emitted so large a quantity of smoke, with muriatic and sulphurous acid fumes, that it was impossible to approach it except in the direction of the wind; and it threw up every two or three minutes showers of red hot stones. The lava was flowing from an aperture about one hundred yards below it, being apparently forced out by elastic fluids, with a noise like that made by the steam disengaged from a pressure engine; it rose, perfectly fluid, forming a stream of from five to six feet in diameter, and immediately fell, as a cataract, into a chasm about forty feet below, where it was lost under a kind of bridge formed of cooled lava; but it re-appeared sixty or seventy yards further down. Where it issued from the mountain, it was nearly white hot, and exhibited an appearance similar to that which is shown when a pole of wood is introduced into the melted copper of a foundry, its surface appearing in violent agitation, large bubbles rising, which in bursting produced a white smoke; but the lava became of a red colour, though still visible in the sunshine, where it issued from under the bridge. The force with which it flowed was so great, that the strength of the guide, a very stout young man, was insufficient to keep a long iron rod in the current. The whole of its course, with two or three interruptions, where it flowed under a cooled surface, was nearly three-quarters of a mile, and it threw off clouds of a white smoke. It smoked less as it cooled and became pasty; but even where it terminated in moving masses of scoria, smoke was still visible, which became more distinct whenever the scoria was moved, or the red hot lava in the interior exposed.

Having ascertained that it was possible to approach within four or five feet of the lava, and to examine the vapour immediately close to the aperture, I returned the next day, having provided the means of making a number of experiments on the nature of the lava, and of the elastic fluids with which it was accompanied. I found the aperture nearly in the same state as the day before, but the lava spread over a larger surface, forming an eddy in the hollow of the rock, over which it fell, from which it could be raised in an iron ladle more easily than from the current, and where there was much more facility of placing and withdrawing substances intended to be exposed to its agency.

One of the most important points to be ascertained, was, whether any combustion was going on at the moment the lava issued from the mountain. There was certainly no appearance of more vivid igni-

tion when it was exposed to air, nor did it glow with more intensity when it was raised into the air by an iron ladle. I put the circumstance, however, beyond the possibility of doubt: I threw some of the fused lava into a glass bottle furnished with a ground stopper, containing siliceous sand in the bottom: I closed it at the moment, and examined the air on my return. A measure of it mixed with a measure of nitrous gas gave exactly the same degree of diminution as a measure of common air which had been collected in another bottle on the mountain.

I threw upon the surface of the lava, nitre, both in mass and in powder. After this salt had fused, there was a little increase of vividness in the ignition of the lava, but much too slight to be referred to pure combustible matter in any quantity; and on making the experiment on a portion of lava taken up in the ladle, it appeared that the disengagement of heat was partly owing to the peroxidation of the protoxide of iron, and to the combination of the alkali of the nitre with the earthy basis of the lava; for where the nitre had melted, the colour had changed from olive to brown. This conclusion was still further proved by the circumstance, that chlorate of potash thrown upon the lava did not increase its degree of ignition so much as nitre. When a stick of wood was introduced into a portion of the lava, so as to leave a little carbonaceous matter on its surface, nitre or chlorate of potassa then thrown upon it caused it to glow with great brilliancy. Some fused lava was thrown into water, and a glass bottle filled with water held over it to collect the gas disengaged; it was in very minute quantity only, and when analyzed on my return proved to be common air, a little less pure than that disengaged from the water by boiling. A wire of copper of $\frac{1}{20}$th of an inch in diameter, and a wire of silver of $\frac{1}{30}$th, introduced into the lava near its source, were instantly fused: an iron rod of $\frac{1}{8}$th of an inch, with a piece of iron wire of about $\frac{1}{30}$th, were kept for five minutes in the eddy in the stream of lava; they were not fused; they did not produce any smell of sulphuretted hydrogen when acted on by muriatic acid. A tin-plate funnel filled with cold water was held in the fumes disengaged with so much violence from the aperture through which the lava issued: fluid was immediately condensed upon it, which was of an acid and subastringent taste. It did not precipitate muriate of baryta; but copiously precipitated nitrate of silver, and rendered the triple prussiate of potassa of a bright blue. When the same funnel was held in the white fumes above the lava where it entered the bridge, no fluid was precipitated upon it, but it became coated with a white powder which had the taste and chemical qualities of common salt, and proved to be this substance absolutely pure. A bottle of water holding about $\frac{3}{4}$ of a pint, with a long narrow neck, was emptied immediately in the aperture from which the vapours pressing out the lava issued, and the neck was immediately closed. This air examined on my return was found to give no absorption with solution of potassa; so that it contained no notable proportion of carbonic acid, and it consisted of 9 parts of oxygen and 91 of azote. There was not the least smell of sulphur-

ous acid in the vapour from the aperture, nor were the fumes of muriatic acid so strong as to be unpleasant; but during the last quarter of an hour that I was engaged in these experiments, the wind changed, and blew the smoke from the crater upon the spot where I was standing: the sulphurous acid gas in the fumes was highly irritating to the organs of respiration, and I suffered so much from the exposure to them that I was obliged to descend; and the effect was not transient, for a violent catarrhal affection ensued, which prevented me for a month from again ascending the mountain.

On the 6th of January I made another visit to Vesuvius. I found the appearance of the lava considerably changed; the bocca from which it issued on the 5th of December was closed, and the current now flowed quietly and without noise from a chasm in the cooled lava about three hundred feet lower down. The heat was evidently less intense. I repeated my experiments with nitre with the same results, and exposed pure silver and platinum to the fused lava: they were not at all changed in colour. I collected the sublimations from various parts of the cooled lava above. The rocks near the ancient bocca were entirely covered with white, yellow, and reddish saline substances. I found one specimen of large saline crystals in a cavity, which had a slight tint of purple: this examined, proved to be common salt with a minute portion of muriate of cobalt. The other sublimations consisted of common salt in great excess, much chloride of iron, some sulphate of soda; and by the test of muriate of platinum, there appeared to exist in them a small quantity of sulphate or muriate of potassa; and a solution of ammonia detected the presence of a minute quantity of the oxide of copper.

During the months of January and February I made several visits to the top of Vesuvius: I shall not particularize them all; but shall mention only such as afforded me some new observations. On the 26th of January, the lava was seen nearly white hot through a chasm near the place where it flowed from the mountain. I threw nitre upon it in large quantities through this chasm, in the presence of H. R. H. the Prince of Denmark, whom I had the honour of accompanying in this excursion to the mountain, and my friend the Cavaliere Monticelli: there was no more increase of ignition than when the experiment was made on lava exposed to the free air. The appearance of the sublimations was now considerably changed: those near the aperture were coloured green and blue by salts of copper; but there was still a great quantity of muriate of iron. I have mentioned, that on the 5th the sublimate of the lava was pure chloride of sodium: in the sublimate of January 6th, there were both sulphate of soda and indications of sulphate of potassa. In the sublimates that I collected on the 26th, the sulphate of soda was in much larger quantities, and there was much more of a salt of potassa. From the 5th of December to the 20th of February, the lava flowed in larger or smaller quantities, so that at night a stream of ignited matter was always visible, more or less interrupted by cooled lava. It changed its direction according to the obstacles it met with; and never, according to appearances, extended so much as a mile from its source.

During the whole of this time the craters, of which there were two, were in activity. The large crater threw up showers of ignited ashes and stones to a height apparently of from 200 to 500 feet; and from a smaller crater, to the right of the large one on the side of Naples, steam arose with great violence. Whenever the crater could be approached, it was found incrusted with saline incrustations; and the walk to the edge of the small crater on the 6th of January was through a mass of loose saline matter, principally common salt coloured by muriate of iron, in which the foot sunk to some depth. It was easy, even at a great distance, to distinguish between the steam disengaged by one of the craters, and the earthy matter thrown up by the other. The steam appeared white in the day, and formed perfectly white clouds, which reflected the morning and evening light of the purest tints of red and orange. The earthy matter always appeared as a black smoke, forming black clouds; and in the night it was highly luminous at the moment of the explosion.

On the 20th of February, the small crater which had been disengaging steam and elastic matter, began to throw out showers of stones; and both craters, from the 20th to the 23d, were more than usually active. On the night of the 23d, at half past 11 o'clock, being in my bed-room at Chiatimone, Naples, I heard the windows shake; and going to the window, I saw ascending from Vesuvius a column of ignited matter to a height at least equal to that of the mountain from its base; and the whole horizon was illuminated, notwithstanding the brightness of the moon, with direct volcanic light, and that reflected from the clouds above the column of ignited matter. Several eruptions of the same kind, but upon a smaller scale, followed at intervals of a minute and a half or two minutes; but there were no more symptoms of earthquake, nor did I hear any noise. On observing the lava, it appeared at its origin much broader and more vivid; and it was evident that a fresh stream had broken out to the right of the former one. On the morning of the 24th I visited the mountain; it was not possible to ascend to the top, which was covered with clouds, nor to examine the orifice from which the lava issued. The stream of lava near the place where it terminated was from 50 to 100 feet broad. It had precisely the same appearances as the lava which had been so long running. I collected the saline matter condensed upon some of the masses of scoria which were carried along by the current and deposited on the edge of the stream; they proved to be the same in the nature of their constituent parts as those of the lava of the 26th of January, but with a larger proportion of sulphate of soda, and a smaller proportion of muriate of iron; and I have no doubt that the dense white smoke which was emitted in immense columns by the lava during the whole of its course, was produced by the same substances.

I shall now mention the state of the volcano at some other periods.

When I was at Naples in May, 1814, the crater had the appearance of an immense funnel, closed at the bottom, with many small apertures emitting steam; and on the side towards Torre del Greco,

there was a large aperture, from which flame issued to a height of at least 60 yards, producing a most violent hissing noise. This phenomenon was constant during the three weeks I remained at Naples. It was impossible to approach sufficiently near the flame to ascertain the results of the combustion; but a considerable quantity of steam ascended from it. When the wind blew the vapours upon us, there was a distinct smell both of sulphurous and muriatic acids. There was no indication of carbonaceous matter from the colour of the smoke; nor was any deposited upon the yellow and white saline matter which surrounded the crater, and which I found to be principally sulphate and muriate of soda, and muriate of iron: in some specimens there was a considerable quantity of muriate of ammonia.

In March, 1815, the appearances presented by the crater were entirely different. There was no aperture in the crater; it was often quiet for minutes together, and then burst out into explosions with considerable violence, sending fluid lava and ignited stones and ashes to a considerable height, many hundred feet in the air.

These eruptions were preceded by subterraneous thunder, which appeared to come from a great distance, and which sometimes lasted for a minute. During the four times that I was upon the crater in the month of March, I had at last learnt to estimate the violence of the eruption from the nature of the sound: loud and long continued subterraneous thunder indicated a considerable explosion. Before the eruption the crater appeared perfectly tranquil; and the bottom, apparently without an aperture, was covered with ashes. Soon, indistinct rumbling sounds were heard, as if at a great distance; gradually the sound approached nearer, and was like the noise of artillery fired under our feet. The ashes then began to rise and to be thrown out with smoke from the bottom of the crater; and lastly, the lava and ignited matter was ejected with a most violent explosion. I need not say, that when I was standing on the edge of the crater witnessing this phenomenon, the wind was blowing strongly from me: without this circumstance, it would have been dangerous to have stood on the edge of the crater; and whenever from the loudness of the thunder the eruption promised to be violent, I always ran as far as possible from the seat of danger.

As soon as the eruption had taken place, the ashes and stones which rolled down the crater seemed to fill up the aperture, so that it appeared as if the ignited and elastic matter were discharged laterally; and the interior of the crater assumed the same appearance as before.

I shall now offer some observations on the theory of these phenomena. It appears almost demonstrable that none of the chemical causes anciently assigned for volcanic fires can be true. Amongst these, the combustion of mineral coal is one of the most current; but it seems wholly inadequate to account for the phenomena. However large a stratum of pit-coal, its combustion under the surface could never produce violent and extensive heat; for the production of carbonic acid gas, when there was no free circulation of air, must tend constantly to impede the process: and it is scarcely possible

that carbonaceous matter, if such a cause existed, should not be found in the lava, and be disengaged with the saline or aqueous products from the bocca or craters. There are many instances in England of strata of mineral coal which have been long burning; but the results have been merely baked clay and schists, and it has produced no result similar to lava.

If the idea of Lemery were correct, that the action of sulphur on iron may be a cause of volcanic fires, sulphate of iron ought to be the great product of the volcano; which is known not to be the case; and the heat produced by the action of sulphur on the common metals, is quite inadequate to account for the appearances. When it is considered that volcanic fires occur and intermit with all the phenomena that indicate intense chemical action, it seems not unreasonable to refer them to chemical cause. But for phenomena upon such a scale, an immense mass of matter must be in activity, and the products of the volcano ought to give an idea of the nature of the substances primarily active. Now what are these products? Mixtures of the earths in an oxidated and fused state, and intensely ignited; water and saline substances, such as might be furnished by the sea and air, altered in such a manner as might be expected from the formation of fixed oxidated matter. But it may be said, if the oxidation of the metals of the earths be the cause of the phenomena, some of these substances ought occasionally to be found in the lava, or the combustion ought to be increased at the moment the materials passed into the atmosphere. But the reply to this objection is, that it is evident that the changes which occasion volcanic fires, take place in immense subterranean cavities; and that the access of air to the acting substances occurs long before they reach the exterior surface.

There is no question but that the ground under the solfaterra is hollow, and there is scarcely any reason to doubt of a subterraneous communication between this crater and that of Vesuvius: whenever Vesuvius is in an active state, the solfaterra is comparatively tranquil. I examined the bocca of the solfaterra on the 21st of February, 1820, two days before the activity of Vesuvius was at its height: the columns of steam which usually arise in large quantities when Vesuvius is tranquil, were now scarcely visible, and a piece of paper thrown into the aperture did not rise again; so that there was every reason to suppose the existence of a descending current of air.* The subterraneous thunder heard at such great distances under Vesuvius, is almost a demonstration of the existence of great cavities below filled with aëriform matter: and the same excavations which in the active state of the volcano throw out during so great a length of time immense volumes of steam, must, there is every reason to believe, in its quiet state become filled with atmospheric air.†

* In 1814, in 1815, and in January, 1819, when Vesuvius was comparatively tranquil, I observed the solfaterra in a very active state, throwing up large quantities of steam and some sulphuretted hydrogen.

† Vesuvius is a mountain admirably fitted, from its form and situation, for experiments on the effect of its attraction on the pendulum: and it would be

To what extent subterraneous cavities may exist even in common rocks, is shown in the limestone caverns of Carniola, some of which contain many hundred thousand cubical feet of air; and in proportion as the depth of an excavation is greater, so is the air more fit for combustion.

The same circumstance which would give alloys of the metals of the earths the power of producing volcanic phenomena, namely, their extreme facility of oxidation, must likewise prevent them from ever being found in a pure combustible state in the products of volcanic eruptions; for before they reach the external surface, they must not only be exposed to the air in the subterranean cavities, but be propelled by steam; which must possess, under the circumstances, at least the same facility of oxidating them as air. Assuming the hypothesis of the existence of such alloys of the metals of the earths as may burn into lava in the interior, the whole phenomena may be easily explained from the action of the water of the sea and air on those metals; nor is there any fact or any of the circumstances which I have mentioned in the preceding part of this paper, which cannot be easily explained according to that hypothesis. For almost all the volcanoes in the old world of considerable magnitude are near, or at no considerable distance from the sea: and if it be assumed that the first eruptions are produced by the action of sea water upon the metals of the earths, and that considerable cavities are left by the oxidated metals thrown out as lava, the results of their action are such as might be anticipated; for after the first eruptions, the oxidations which produce the subsequent ones may take place in the caverns below the surface; and when the sea is distant, as in the volcanoes of South America, they may be supplied with water from great subterranean lakes; as Humboldt states that some of them throw up quantities of fish.

On the hypothesis of a chemical cause for volcanic fires, and reasoning from known facts, there appears to me no other adequate source than the oxidation of the metals which form the bases of the earths and alkalies; but it must not be denied that considerations derived from thermometrical experiments on the temperature of mines and of sources of hot water, render it probable that the interior of the globe possesses a very high temperature: and the hypothesis of the nucleus of the globe being composed of fluid matter, offers a still more simple solution of the phenomena of volcanic fires than that which has been just developed.

Whatever opinion may be ultimately formed or adopted on this subject, I hope that these inquiries on the actual products of a volcano in eruption will not be without interest for the Royal Society.

easy in this way to determine the problem of its cavities. On Etna, the problem might be solved on a larger scale.

On the Advantages of Machines.

(From Marratt's Mechanical Philosophy.)

Persons unskilled in the nature and power of machines, generally form false notions concerning them: this frequently produces egregious errors, and mischievous speculations. One of the most common conceits of these blunderers, is that of considering this power as capable of being made to increase, and thus multiplying their effects as agents, which is not always true. To form a just notion of the aid which may be expected from machines, looking to the uses to which they are commonly put, we shall divide them into two kinds; namely, 1st. Those which are intended simply to sustain a weight; and, 2nd. Those which are intended to draw it, or to raise it equably.

In machines of the first sort, both the effect of the machine, and the immediate effect of the power, can only be estimated by the weight sustained. This being understood, it is evident that the machine increases the effect of the power; thus a force of 10 pounds, by means of a lever, will sustain 100 lbs., provided the arm belonging to the power be 10 times as long as that belonging to the weight.

If it be asked how the power can ever produce an effect so much greater than itself, the answer, after a little consideration, will be this; the power of 10 pounds *does not*, in reality, sustain the weight of 100 pounds, but only a tenth part of it. For let the lever be one of the second kind; the weight 100 may be resolved into two, the one of which will be 90, and the other 10; the one equal to 90 is supported by the fulcrum, and the power of 10 only sustains the other part of the weight, which is 10 also. *Archimedes* required only a fixed point, to hold the whole globe of the earth in equilibrium. If he had found it, says Carnot, it would not, in fact, have been *Archimedes*, but the fixed point, which would have sustained the earth.

In machines of the second kind, neither the effect of the machine, nor that of the power, can be estimated simply by the weight raised; for, otherwise, the measure of the effect would be altogether vague and indeterminate. In fact, any force, however small, may move a weight, however great, if it only be granted that the weight admits of being divided, and of being carried by one piece at a time. It is necessary then to take notice also of the *time* in which the power can move the weight from one place to another; or to ascertain the velocity with which the body is moved; and on this account it is, that the effect is measured by the weight multiplied by the velocity.

On this principle, we have already shown that the machine does not increase the effect of the force. If a man, acting with a force of 10 pounds, can raise, by means of a machine, a weight of 100 pounds, he must move with a velocity ten times as great as the weight; and, therefore, he does just as much as if, operating without a machine, he carried these 100 pounds at 10 journeys, loading himself with 10 pounds at a time. Hence it is exceedingly plain, that,

what is gained in this way by moving the weight, is lost in velocity, and the effect remains the same.

With respect then to the two kinds of machines above described, there is this characteristic difference; namely, that the first sort add to the effect of the power, while the second do not add to it. There is another difference not less remarkable respecting the resistances of friction, of ropes, and other resistances. In machines of the *first* kind, these resistances are all in favour of the power, and sustain, themselves, a portion of the weight; whence there remains so much less for the power to support. On the contrary, in machines of the *second* kind, the resistances are all of them detrimental to the power, and form part of the weight to be overcome; whence, on this account, a force is required greater than what would be required if there were no resistance.

We can now easily bring into view the true scope and real utility of machines. Machines of the *first* kind, seem to increase the effect of the power; and they do this by distributing the weight conveniently between the power and the prop. Machines of the *second* kind serve not to augment the effect of the power in quantity, but to modify its quality in the manner in which it is wanted; and they do this in the following manner. The effect of the machine being the product of the weight and velocity, we can increase at pleasure *one* of the two factors, provided that the other be proportionably diminished. Thus, by means of a machine, we can move a weight enormously great, provided that we have plenty of time, or are content to do it slowly; or, on the contrary, we can move a weight with a very great velocity provided that this weight be small: indeed, by the immediate application of the power, we can scarcely go beyond certain limits either of velocity or weight.

Another use of machines is that of enabling us to apply to the moving or sustaining of weights those forces which are not immediately suitable to such a purpose, and with that particular direction which is most advantageous for the power. Thus, the impact of a stream of water, or the force of a horse, could not be applied to draw water from a well, or stones from a quarry, unless by the intervention of a suitable machine; and man himself draws water more easily by means of a pulley, than he otherwise could do by pulling the bucket perpendicularly upwards.

It is impossible to lay down rules by which all machines may be disposed in the most advantageous manner; the following hints however will be of service.

First. In machines intended for carrying weights, it is best to reduce the friction, and the other resistances, to the least quantity possible; but not those intended simply to support weights. Therefore, generally speaking, in the first case, *simple* machines are preferable; in the second, *compound* machines.

Second. When the force decreases as the velocity increases, it is best to dispose the machine so that the force of each agent may be exerted to the greatest advantage, which may be done as has been before explained.

Third. In general, it is proper to take care that the whole of the force be employed to the greatest advantage in producing the intended effect; and also that no part of it be wasted on effects foreign to the intended purpose of the machine. Thus, in the lever, if the power act obliquely to its arm, a part of the power will be lost in pressing it against the point of support, with a useless consumption of force to the mere detriment of the machine.

Fourth. When a weight is raised by means of a crank, the mean arm of the lever may be considered as constant, and equal to $\frac{1}{11}$ of the breadth of the crank. Combinations of two, three, or four cranks, variously disposed on the same axle, are sometimes made use of. When four are disposed at right angles to each other, very little power is lost. The single crank is of great use in practical mechanics, and its power is as given above. The investigation is too difficult to be here inserted; it may be made out however in the manner given in FENWICK'S ESSAYS; and a complete demonstration is given in VENTUROLI'S MECHANICS.

Fifth. Simplicity in the construction of machines cannot be too strongly recommended; for a multiplicity of parts, or a variety of motions, increases the expense of erection, augments the friction, and increases the danger of breaking. To reduce a complex machine to a simple one, we must construct the various parts of the simple machine so that the velocity of the impelled point may be to that of the working point in the same ratio as in the complex machine; then the efforts of these two machines are the same in *theory*, but in practice the simpler will be much less subject to friction and accidents.

Notice of a "Treatise on Heat, and its Application in Arts and Manufactures. By E. PECLET." *2 vols. with plates. Paris*, 1828.

[From the Foreign Quarterly Review, published in London.]

WHATEVER consequences may have resulted to France from the memorable occurrences of which she was the theatre at the close of the last century, the national industry received an irresistible impulse, which has carried her forward, ever since, in the career of improvement. The coalition which deprived our Gallic neighbours of all external resources, threw them back upon their own. The effect was magical; arts and manufactures sprang at once into no feeble and infantine existence, but like Minerva from Jupiter's brain. This may be attributed, in great measure, to the subversion of one among many other usages inseparable from antiquated forms of government—the selection of persons from every other cause than merit, to fill responsible and arduous situations. Necessity reversed this procedure in France; talent was cultivated, ability put in universal requisition, and science judiciously employing what were, apparently, the most unpromising materials, almost instantaneously rendered the nation independent. Never did philosophy hold so exalted a rank as when she thus answered the call of patriotism. From

that moment to the present, works have been issuing from the Gallic Press, which developed new principles in every department of science, and directed the application of them, or suggested new processes to modify and improve such as were already known. M. Péclet's treatise belongs to the latter class. The first volume details, 1. the physical theory of heat; 2. the theory of combustion and combustibles; 3. the theory of the movements of heated air; 4. the theory of chimneys. The second volume contains the application of the above—1. vaporization; 2. distillation; 3. evaporation; 4. drying; 5. heating of elastic fluid; 6. heating of liquids; 7. heating of solid bodies; 8. cooling. The author has made very many and ingenious experiments, the results of which prove that an alteration, which we shall hereafter notice, is required in the numerical values of certain terms in the formulæ hitherto employed. There are, besides, many interesting particulars in the book, as will appear in the course of the present article. But the writings of Tredgold and others of our distinguished engineers, have been, of necessity, so incorporated in the work, that, to an English reader, there is nothing new beyond what we shall extract. The total suppression of Dr. Black's name, while his theory is adopted, we regard as a compliment, implying, as it does, his merits to be so generally known, that any notice of his labours must be superfluous. We speak this with sincerity; the candour with which M. Péclet acknowledges the various sources of his information, is so rare among his countrymen, that we point out this instance of it with peculiar pleasure. The following is an ingenious application of a well known fact:—

"The force with which solid bodies tend to change their volume by the variations of temperature, is very considerable. Mr. Molard, former director of the Museum of the Arts, applied it with success. The two side walls of one of the halls of the Museum, had bulged outwards, from the pressure of the vault they supported. To bring them back, Mr. M. pierced the walls with iron bars terminated externally with strong nuts; by screwing up these, the walls could be prevented from a greater divergence, but it was not possible to bring them back to their original position. One half of the bars was then heated by means of lamps placed beneath them; these were consequently lengthened, the screws could be tightened, and the walls were partially brought back. By repeating the operation, the total restoration of the walls was effected."

Admitting, as we do, the theoretical correctness of Saussure's hygrometer, we were much astonished at the author's high opinion of its practical utility; Despretz having shown from numerous and direct observations, that not the least reliance can be placed on its indications. The blind acquiescence, likewise, with which Sir H. Davy's explanation of the theory of his safety lamp is received, seems unaccountable, a more satisfactory hypothesis having been given by an Italian philosopher, M. G. Libri, of Florence, who ascribes its effect to the repulsive force of the metallic wire forming the gauze, not allowing the flame to pass through its interstices. The relative quantity of radiant heat which alone is applicable to domestic pur-

poses, from different combustibles, has been variously stated, some authors estimating it at only a few hundredths of the total heat disengaged; the subject received M. Péclet's especial attention; the apparatus he employed it is needless to describe; the results are as follow:—With wood, the quantity of heat dispersed by radiation, is to the total heat developed : : 1 : 3.74. The quantity of radiant heat is to that carried off by the chimney : : 1 : 3. With charcoal, these proportions are respectively 1 : 2.36 and 1.236 : 1. With coal, these quantities were not determined, from the difficulty attending the experiments; it is, however, conjectured by the author, that the power of radiation is superior to that of charcoal, and that with coke it is very much more so. With peat, and the charcoal from it, the approximate ratios are 1 : 2.6 and 1 : 1.6. From the superiority of the apparatus employed, and the care bestowed on the investigation, these results may be received with confidence. Of the formulæ hitherto, with but few exceptions, universally adopted for ascertaining the velocity of heated air, it is remarked that they are not at all exact; they assign

"For the height of the column which generates the velocity, the difference between the column of cold external air, and that of the column of warm air reduced to the density of the external air; but the velocity thus obtained is that which cold air, subjected to the same pressure, would have, and not that of the warm air. The difference may be considerable, for in the example we have selected, the velocity of the warm air is in value 19.18, while calculated according to the preceding principle, it would be only 16.33 metres."

If then h represent the height of the column of heated air, t the external, and t' the internal temperature, m the dilatation of air for each degree of the centigrade thermometer, the height of the column of cold air reduced to 0° is $h\left(\frac{1}{1+tm}\right)$ and at the temperature t' is $h\left(\frac{1}{1+tm}\right)(1+t'm)$ consequently the height of the column which generates the velocity, is $h\left(\frac{1+t'm}{1+tm}-1\right)$ and v, the velocity given by the formula, $=\sqrt{2gh\left(\frac{1+t'm}{1+tm}-1\right)}$ whereas v, as assigned by Tredgold and others $=\sqrt{2gh\left(1-\frac{1+tm}{1+t'm}\right)}$ which values, differing only in the last factors, will be to each other as these factors : : $\sqrt{\frac{1}{1+tm}} : \sqrt{\frac{1}{1+t'm}}$. Various philosophers, M. d'Aubuisson in particular, have investigated, by different methods, the resistance air meets with in passing through pipes; M. Péclet subjected the matter to direct experiment. "For that purpose I got chimneys constructed of pottery, sheet-iron, and cast-iron. I varied the diameter and height of them, and the temperature of the air which circulated through them, and I have determined with

great precision the time which the air required to pass through them, from whence I easily deduced the velocity of the air in each particular case. Then comparing the numbers obtained by experiment, I perceived that the resistance to the passage of warm air through channels, was proportioned to the length of the latter, but inversely as their diameter, and directly as the square of the velocity; and I have ascertained the factor by which the velocity assigned by theory is to be multiplied to obtain the actual velocity."

The regular series of experiments was made upon cylindrical chimneys; detached observations, however, upon rectangular ones, indicate that the laws are the same for both, while for those that are compressed, it is only necessary to take the smaller diameter. The factor, then, by which the velocity assigned by theory is to be multiplied to obtain the real velocity of pure heated air, is $2.06\sqrt{\frac{D}{L+4D}}$ for baked earth, D being the diameter, and L the length of the canal —$3.25\sqrt{\frac{D}{L+10D}}$ for sheet-iron—and $4.61\sqrt{\frac{D}{L+20D}}$ for cast-iron. If the air is to be considered as half burnt, these quantities respectively, are to be multiplied by 0.97, a term depending on the chemical alteration which influences the density of the air in that state. This is a valuable contribution to practical science, and we trust that it will not escape the attention of the engineers in this country, engaged in the construction of works for which great heat is required. With respect to chimneys, a subject on which no difference of opinion as to theory exists, but the execution of which being unfortunately left, for the most part, to mere builders, comparatively ignorant men, occasions much annoyance in private houses, and serious loss in larger establishments, we found nothing new in the work before us.

An improvement introduced by M. Gourlier, in the Exchange in Paris, having obtained a patent in this country, we rather think the patentee did not anticipate the French architect, but do not recollect the precise date of the specification. The improvement consists in employing grooved bricks of different forms, so that the joints may cover each other, which, when united, may form cylindrical channels of nine or ten inches internal diameter, of sufficient size, consequently, for the purpose of heating and ventilating the apartments, and which may be introduced into the thickness of the walls without impairing their strength. The most valuable inventions and improvements in the arts in England, are not such as meet the public eye. There is too much clashing of interest, too great competition among the manufacturers, to allow of this, and the jealousy with which they regard each other, extends, in a stronger degree, to foreigners. Strangers, therefore, who feel the superiority of England, and while seeing the effects of our national industry, estimate the means of their production by published accounts, invariably overrate our artisans or undervalue our engineers—the former, for executing so much with what are described as not the most perfect

apparatus; the latter, for apparent neglect or ignorance of the support which science affords to every branch of art. M. Dupin, from personal experience, judged more correctly. M. Péclet does not run into either extreme; he speaks highly of the great English establishments; regards, for example, with astonishment, the Scotch distilleries, where, by employing alembics, about 44 inches in diameter, and 5 inches in depth, or from 52 to 54 inches in diameter, and about 8 inches in depth, their contents, 44 and 80 gallons respectively, are heated, completely distilled, and the alembics refilled; the first in two minutes and a half, the last in three minutes and a half; but he seems to think that theoretical refinements are too much overlooked. Now, it is precisely in these details that wholesale operators vie with each other, and it is these secrets which would be, and are, most jealously guarded from every eye. The consequence is, that books on practical subjects are necessarily in arrear—the initiated will not speak, the uninitiated are unable to do so; and M. Péclet, as well as the rest, in describing the various processes connected with heat, has done nothing more than afford the reader a general idea of the means and mode of proceeding. For this, we refer to the work itself, which will be found a valuable addition to every library, and shall insert only a few particulars, which, to us, appear interesting. Having spoken of the calcareous concretions which form on the bottoms of boilers, and used to occasion much inconvenience, he proceeds:—

"A simple and very efficacious method is now known of preventing the incrustations in question; it is to add from 26 to 33 pounds weight of potatoes to the water in a boiler which consumes from 55 to 66 pounds of coal per hour; the boiler may then be employed for 20 or 30 days without being cleaned, and without any fear of a calcareous deposit. After this time the mud must be thrown away, and the same quantity of potatoes again be added. It appears that the fecula, by dissolving in the water, renders this sufficiently viscous to prevent the deposition of the calcareous matter. Flour would produce the same effect, and much less of it would be required."

The following is the most striking instance of its kind that we have met with, which shows how easily the presence of extraneous bodies in boilers tends to injure them.

"A few days after the steam boiler designed to heat the Exchange in Paris was brought into use, it was perceived that there was a hole in the bottom. The fire was extinguished, and it was found, upon emptying the boiler, that the metal was burnt in a place where a rag (*chiffon*,) had been deposited, which had been forgotten when the apparatus was set up."

Our countrymen, who regard with such pleasure the cheering blaze of their domestic hearth, will learn with regret, that, "of all the modes of warming houses, the very worst are open chimneys, then stove-grates, then stoves." The fact is, that in England we regard the appearance of comfort almost as much as the reality, and are frequently content to make some personal and pecuniary sacrifice, sooner than forego the pleasure of *seeing* our enjoyments. Paradoxi-

cal as it may seem, a person acquainted with human nature will find both sound sense and economy in this, while the heartfelt results of our personal experience will render nugatory the cold calculation of philosophy. But taking into account the national habits, we doubt if any other system of warming houses can be introduced into England than that at present in use. M. Péclet may laugh, as we do ourselves, at Dr. Arnott's absurd speculations in the construction of grates, and the ridiculous monstrosities of Messrs. Atkins and Marriott; he may denounce, and justly, the inordinate and preposterous capacity of our chimneys; but the former are not to be considered as standard specimens of British ingenuity, and the defects of the latter, long since signalized among ourselves, are gradually disappearing in a more rational style of architecture. For large establishments, steam may be employed with advantage; under some circumstances the adoption of stoves may be desirable; but for the general purposes of English domestic life, the open fire-place is indispensable. Nor, adopting the data given by M. Péclet, is any loss of fuel occasioned thereby, when all the purposes for which it is required are taken into account, and the construction that of our best manufacturers. Nations, if not individuals, will gradually improve, as they adopt what their necessities require, anticipating by their practice the suggestions of theory.

"Among the worst conductors must be ranked air, when it is perfectly at rest. Hence, one of the most efficacious means for retarding bodies from cooling, may be easily conjectured, which consists in surrounding the body with one or more envelopes, at a distance from the body, and from each other. The strata of air surrounding the body and its envelopes, without being able to escape, will allow the heat to escape only with extreme difficulty."

Now, this is an exact description of a Chinese tea-pot; a cylindrical metallic vessel closely stopped, inserted in a square wooden box, of at least double capacity, with a cover accurately fitted, and a small orifice in the side, through which the minute aperture of the spout appears. If water boil when poured into this apparatus, more than twenty-four hours are required to cool it.

The mathematical theory of heat, so powerfully developed last year, by M. Fourrier, of the Institute, is not alluded to in the present work. To this subject we shall return at a future time, and in taking leave of M. Péclet, equally admire the ingenuity he has displayed in his own researches, and his judgment in applying the labours of others.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS GRANTED IN JUNE, 1829.

With Remarks and Exemplifications, by the Editor.

1. For *Manufacturing Woollen Cloth suitable for Carpeting, Floor-cloths, Rugs, Table-covers, Blankets, Padding,*

and other purposes. First patented March 3d, 1829. Afterwards surrendered for the purpose of correcting the specification, and re-issued June 11th; William Harrington, Harrison, West Chester county, New York.

At page 412 of our last volume, we particularly noticed the original patent. In that specification, the only article proposed to be manufactured was *Woollen Carpet*, or *Carpeting*. In the amended specification, as will be seen by the caption, a number of other articles are enumerated. The mode of procedure is more distinctly explained, and the claim of the patentee thus expressed.

"I do not claim as my invention any one of the machines used in the above described method of manufacturing woollen cloth, nor any particular part of any one of the machines; but I claim that I am the first person who, by passing sheep's wool through the above described or similar operations, and by a combination of the above described or similar machinery, has been able successfully to manufacture woollen cloth of sufficient firmness of texture, strength, and durability, to answer the valuable purposes named in this specification, without spinning, or weaving, upon the principles of felting. The subscriber is not aware, that any one has heretofore been able successfully to avail himself of the well known felting properties of sheep's wool, for the purpose of manufacturing cloth, suitable for carpeting and other valuable purposes named in this specification."

Within two months, five patents, we believe, have issued for a purpose similar to the foregoing; we are therefore likely to have the practicability, or rather the eligibility of the thing fairly tested; and it is highly probable also, that the claims of the patentees to originality, may likewise have to pass the ordeal of the law.

Numerous attempts have been made, and large sums invested, in this manufacture. A patent was obtained in England, for the manufacture of cloth by felting, upwards of thirty-five years ago, and several different establishments formed, but all eventually abandoned, because the cloth made, was less durable than that which was woven.

We recollect a similar attempt made in the vicinity of Philadelphia about thirty years ago, by two Englishmen, who came over with the express determination of establishing the manufacture. We saw specimens of the cloth, the appearance of which was good; but the state of the country was not then favourable to such a project, and the intrinsic defect of want of strength in the texture, was urged against it.

The claim of the present patentee, is, as appears to us, to his having succeeded; we hope this claim may be a durable one. In the enumeration of the articles, his new patent is much broader than the old; the correctness of this admits of some doubt; we have always entertained the opinion that an amended specification may omit old, but ought not to contain new claims; and that the principal intention was to afford an opportunity for giving that precision and clearness to the instrument which had been at first unwittingly neglected.

2. For an improvement in the manufacture of *Glass Knobs for Drawers*, Doors, Shutters, &c.; Deming Jervis, Boston, Massachusetts, June 11.

The glass knob, instead of being perforated, in the usual manner, for the reception of a metallic screw, is pressed into a mould, so made as to form the knob with a shank of solid glass, furnished with a screw. On account of the brittleness of the material, the shank is made large. The claim is to the making of glass knobs, 'having a glass shank, with a screw upon the shank.'

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3. For a *Washing Machine;* Fredus Reed, Piketown, Bradford county, Pennsylvania, June 11.

The trough in which the clothes are to be washed, has an iron shaft extending its whole length, supported by, and working in, two uprights. This shaft is placed above the back edge of the trough, and has on it four cranks, standing at right angles to each other. The washing is effected by four paddles, the upper ends of which are attached to the cranks, whilst their lower dip into the trough, and agitate the clothes, the back edge of the box serving as a fulcrum, or thole, for the paddles.

"What I claim as my invention, is, the application of the crank shaft to the paddles, or arms, so as to cause them to operate alternately, as above described, said paddles not having been heretofore employed for the washing and cleaning of clothes." And it is much to be doubted whether they will be employed hereafter.

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4. For a machine for *Thrashing, Smutting, Winnowing, and Screening Grain*, called 'Davis and Carey's improved Thrashing Machine;' Elisha P. Davis, and William Carey, Riga, Monroe county, New York, June 11.

In general structure this machine is similar to many others, but its particular arrangements could not be shown without a drawing. The thrashing cylinder is to be covered with sheet iron, punched like a grater, with the burs projecting outwards. The hollow segment, opposite to which it revolves, is to be similarly lined; this is to cause it to operate as a smut cleaner. Spikes of two inches in length project from each, for the purpose of thrashing out the grain, which, with the chaff, falls through a screen into the winnowing chamber. A cylinder, provided with spikes, revolves, and removes the straw.

The patentees do not claim the invention of effecting either of the processes by machinery, nor any of the arrangements of parts which may be found in other machines, but only the particular combination by which all are performed in this machine. They claim the covering of the cylinder and segment with sheet iron, to serve as a smut machine, and to protect them from wear. They mount the cylinder on steel points instead of journals, and this they claim. They also claim the screwing of the spikes into the cylinder and segment, in-

stead of driving them; this is to prevent their flying out. The regulating the distance of the cylinder from the segment, by means of screws and springs, instead of wedges, is likewise claimed.

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5. For sundry new and useful improvements in the construction of *Rail-ways, and Rail-way Carriages;* Isaac Knight, Baltimore, Maryland, June 11.

The objects embraced, are too numerous to be inserted here. The description of them occupies a dozen pages, which we will endeavour to condense, and publish; probably in the present number.

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6. For an improved mode of *Producing Fire and Light;* Isaiah Jennings, New York, June 11.

Sulphuric acid is to be hermetically sealed in a small glass tube or bulb, and this is to be enclosed in a paper, surrounded by a mixture of oxymuriate of potash, sulphur, and sugar, or other ingredients which will inflame by the contact of sulphuric acid. The paper may be oiled, waxed, or varnished, and folded up, to serve the purpose of a match. To light this match, the included glass is to be broken, which brings the acid in contact with the inflammable materials. The advantage presented by this plan, is, the preservation of the acid for any length of time; the disadvantage, that such matches will be too costly for general consumption.

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7. For an improvement in the *Construction of Lamps, and the Economy of Light;* Isaiah Jennings, New York, June 11.

The lamp referred to in the specification of this patent, resembles one for which Mr. Jennings obtained a patent on the 3d of March last, and, like that, is principally intended for the burning of tallow, and other thick fatty substances. A globular body of glass is to contain the fat or oil. A copper tube of half an inch in diameter passes through a cork, fitted into an opening in the lower part of this body, and extends up so as to stand even with its upper surface, which has an opening of about 1¼ inch in diameter, so as to allow a space around the metal tube. This tube is surrounded with folds of cotton, to answer the purposes of a lamp-wick, so far as capillary attraction is concerned, but terminates about half an inch below the top of the copper tube; above this a short piece of circular wick is put on, which is to extend a little above the top of the tube, for the purpose of being ignited. There is no means of raising this wick, as it is to be renewed when necessary. The patentee has engaged to send one of his lamps for trial, when, should it justify the character which he gives to it, we will furnish an exact description of it with a drawing.

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8. For an *Hydraulic Steam Engine;* John Catlin, Cincinnati, Hamilton county, Ohio, June 11.

This is in fact an engine working entirely upon the principle of Savary's engine. It is said to be "peculiarly applicable to mills already erected on streams which fail during part of the year, as the expense of constructing it is much less than of an ordinary steam engine of equal power."

Savary's engine, as usually described, was to operate both as a sucking and forcing pump. The water being first raised, by the pressure of the atmosphere, into a chamber, in which a vacuum had been produced by the condensation of steam, and then forced up a rising main by the pressure of steam acting upon the surface of the water. In the arrangement now proposed, the forcing operation is the only one employed. Two or more cylinders are made of wood, and are placed in the reservoir from which the water is to be raised, so that it will flow into them without the aid of a vacuum. Wood is chosen because it is a bad conductor of heat. Floats of wood are to rise and fall within these cylinders, and are to operate as pistons; they are to be "closely fitted without touching the sides, to separate the steam from the surface of the water, and thereby prevent its condensation." After these cylinders have been filled with water, through a valve in their bottoms, steam is to be admitted into them, above the float, and is, by its elasticity, to force the water to the required height. The patentee says:

"The improvement for which I claim exclusive privilege, is, the use of wood, or other non-conducting materials, to construct the vessels, or cylinders, and floats, above described, and to line with the same material, iron, or other metallic vessels, or cylinders, for the alternate reception and discharge of steam and water."

It will be no easy task to *fit the floats closely without touching the sides*, so as to prevent the water from passing above them, when under the pressure of a high column in the rising shafts. The slowness with which wood conducts heat, would be an advantage in this plan, but the impossibility of making it keep its form and dimensions under the action of water and steam, will render some unmentioned provision necessary, or it must be fatal to the whole scheme. Steam of two atmospheres will be necessary to raise water to the height of thirty feet upon this plan.

In situations where fuel is cheap, an economical engine for raising water from a tail race, into a dam, might be advantageously employed during seasons of drought; but it rarely happens that there is a supply in the tail race, when there is a deficiency in the dam; it is therefore in but few places that such an apparatus would be of any avail; it has, however, been effected in some places, but the very nature of things forbids its frequent adoption.

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9. For an improved *Cotton Gin;* Stephen T. Conn, New York, June 11.

The roller cotton gin consists of two rollers, about sixteen inches in length, which are made to turn something like the rollers of a flatting mill. The seed cotton being forced against these, the cotton

is drawn through the rollers, and the seed left behind. Such rollers, it is stated, become heated in use, sufficiently to set fire to the cotton. The improvement claimed is to the making them hollow, so as to admit air freely, which, the patentee avers, will obviate this objection. If desired, a current of air, or even of water, may be made to pass through them.

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10. For a *Cast Iron Cooking Stove;* Allen and James Barnett, Louisville, Jefferson county, Kentucky, June 11.

This is an ingeniously constructed stove, and probably a very good one. The fire is placed immediately below the *upper* plate, and there are perforations in this plate for kettles, pans, &c. The oven is *below* the fire, and the flame and smoke are made to descend by four flues, one at each corner, forming a semicircular projection at each angle of the stove. These flues are carried under the oven, so as to distribute the heat equally, and the smoke at length escapes by four contiguous openings at one side, and at the bottom of the stove, where a common pipe connects them with the chimney.

The claim is to "the *projecting flues*, which render the fire department more square and compact than any other. The advantage derived from *four flues*, by which the flame, or heat, is drawn from the centre to each corner of the fire department, passing with great regularity under the boilers, and then descending and passing through the horizontal flues, by which it is distributed with unequalled regularity and effect, under the oven; the said horizontal flues being connected, and cast with the bottom plate of the oven."

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11. For an improvement in the *Bar-share and Shovel Plough;* James Boatwright, Columbia, South Carolina, June 11.

A bar, or plate, of wrought iron, from four to ten inches wide, and from fourteen to sixteen inches long, is to have its ends cut off obliquely, so as to form an angle of about 46 degrees with the sides; these ends are to be steeled and sharpened. This plate is to be bent in a regular curve, lengthwise, upon a cylinder of about twenty-one inches in diameter. The plate, or share, is then to be bolted on to the helve, or chip, with one edge downwards. The specification states, that,

"Among the advantages of this improved share, the following may be enumerated. Either end may be used, or the form of the ends may be varied, so as to be applicable to different purposes; it may be used either with or without a coulter, as circumstances require; it requires no mould board; is light, effective in its operation, and simple in its construction."

"What I claim as new, and an improvement, in this plough, is the form of the share, which can be used at either end, and which, by its peculiar form, acts as a mould board and share, consequently supersedes the necessity of attaching a separate mould board."

This plough is said to answer well in the district of country where the patentee resides. Where the soil is light, and the ploughing is

intended to be shallow, we have no doubt of its adaptation to the purpose; and this we presume is all that is expected by the inventor.

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12. For an improvement in the *Rail-road*, by which a railway carriage may be made to turn out and in, at the places intended for that purpose, on a single rail-way; or to pass from one track to another, where the road is double; which mode obviates the difficulties heretofore experienced in effecting this object; James Wright, Columbia, Lancaster county, Pennsylvania, June 11.

A plate is in the hands of the engraver, to accompany the specification of this patent, and the one obtained by the same gentleman, in April last.

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13. For an improved *Rifle for sharpening Scythes* and other edged tools; Beriah Swift, Washington, Dutchess county, New York, June 11.

Emery of a suitable size is to be fixed upon properly shaped strips of wood, by means of a mixture of oil-paint, and varnish, which, when dry, forms the substitute for the stones usually employed.

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14. For an improvement in manufacturing *Wool, or other fibrous material*, being a method of taking the wool, or other material, more readily from the doffer than heretofore; John Goulding, Dedham, Massachusetts, June 11.

Small rollers, covered all over with fillet card-wire, are placed in front of the doffer cylinders, from which they take the wool, and deliver it into small revolving tubes, through which it is drawn by fluted rollers. Reference is had to a patent formerly obtained, and upon which this is an improvement; figures of both would be necessary to a perfect description.

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15. For an improvement in the *Commode Knob*, for drawers, and other articles of furniture; Elijah Skinner, Sandwich, Stafford county, New Hampshire, June 11.

This *improvement* consists in using turned wooden knobs, around which ferrules of brass are to be put, and circular plates of brass let into their faces, and polished. Economy is the object in view in this *invention*.

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16. For a machine for *Thrashing Grain, or other substances*, called 'Fuller's Portable Thrashing Machine;' George Fuller, Gardiner, Kennebeck county, Maine, June 11.

A horse, ox, or other heavy animal, is to travel upon an inclined wheel, which by bevelled gearing is to give motion to a thrashing cylinder, with beaters, and also to a feeding apron, just like other

thrashing cylinders, and feeding aprons. The whole is to be placed upon truck wheels, so that it may be drawn about from place to place.

"I do not claim a right to the inclined wheels, or to the beaters; but I claim as my invention, the particular combination of machinery attached to the inclined wheel, for moving the beaters, for the purpose of thrashing grain, &c."

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17. For an improvement in the *Hollow Auger*, for tenoning the spokes of wheels; Abel Conant Pepperell, Middlesex county, Massachusetts, June 11.

After the spokes of a wheel have been driven into the nave, or hub, the ends which are to pass into the rim have to be rounded. This is frequently done by a hollow auger, which leaves the tenons in the form of round pins; it is this hollow auger upon which improvements are now claimed. The auger is to be made in two pieces. The front piece, upon which is formed the cutting face, is so perforated from end to end, as that the hollow may be in the form of the frustum of a cone, the smaller end being towards the cutters; this is for the purpose of avoiding friction from the tenon within the hollow. The back part of the auger is solid, one end being fitted and fixed into the larger end of the conical part. The back end of the shank is squared, to fit a common bit stock, with which it may be turned. The auger is fitted into two collars, like the mandrel of a lathe; in these collars it has a traversing motion. The hub, with its spokes, are to be fixed to turn on a centre, and the spokes are brought in succession opposite to the hollow auger, properly fixed and adjusted for the purpose of cutting. There is a collet upon the shank of the auger, behind the back collar; this, when the auger has bored far enough, comes in contact with the collar, and all the shoulders are, consequently, at precisely the same distance from the centre of the wheel.

The form of the cutting edges, of which there are two upon the face of the auger, differs somewhat from that ordinarily given to it.

The claims are to making the auger in two parts;—making the inside conical;—giving to the cutting edges a more curved form than usual, and the mode of supporting and using the auger.

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18. For a *Machine for Making Hat Bodies;* Hiram Chase, and Alexander Clark; the former of Tisbury, in Dukes county, the latter of Falmouth, in Barnstable county, Massachusetts, June 11.

The wool is carded upon the ordinary carding machine, but is taken off from the main cylinder by *conical* doffing rollers, covered with cards, there being two of these doffing rollers, one under the other, in front of the cylinder, their larger ends standing in reversed directions. Steel doffing plates remove the wool from these conical rollers, when it winds around conical formers placed ready to receive it. Against these conical formers it is pressed by a second cone,

which bears up against the *former*, on the side opposite to the doffing comb; this pressure gives to the body sufficient solidity, to enable it to be removed from the former.

A vibrating motion is given to the carding machine for the purpose of regulating and varying the thickness of the body. To accomplish this object, the supports of the forming rollers are not attached to the carding frame, but to the floor, by a distinct frame.

The claims are:

"1st. The application of the two conical doffing cards, for the purpose of taking the wool from the main cylinder."

"2nd. The moving, or vibrating the carding machine, for the purpose of varying the thickness of the body."

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19. For *a Churn;* Cotton Foss, Perry, Geauga county, Ohio, June 11.

This churn is made in the form of the common dasher churn, but larger. The head is to be secured on by a cleat; a shaft passes through the head, which is to be turned by a crank, in the manner of the ordinary barrel churn; revolving dashers, placed spirally, are attached to the shaft, within the churn.

The body of the churn is to be laid upon a bench, standing obliquely, its axis forming an angle of about 35 degrees with the horizon.

The spiral direction of the floats, or dashers, and the oblique position of the churn, form the claims.

From good cream, this churn may make good butter, as quickly as other churns, and with as little waste, provided the loose head be well fitted and secured, and the cream do not escape at the shaft.

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20. For a new and useful mode of *Propelling Boats, or Wagons;* Josiah White, civil engineer, Mauch Chunk, Pennsylvania, June 11.

The principal object of this invention is to use propellers of timber, to cause wagons or cars to ascend on an inclined plane, instead of drawing them up by ropes, or chains.

The propellers are long pieces of timber, placed between the ways of a rail-road. They are to be three in number, lying side by side, and may be on the same plane with the rails; they are proposed to be made of timber, about 6 by 8 inches, and may be so joined end to end as to extend to any convenient distance; they are to be supported on rollers, upon which they are retained by flanches. A shaft crosses the rail-road, below the rails and the propellers; upon this shaft there are three cranks, from each of which a pitman passes to one of the propellers, and when this shaft is turned, by the application of any sufficient power, one of the propellers will always be advancing. The upper edges of these propellers are notched, so as to form ratchets; and three palls descend from the bottom of the

wagon, and fall into these ratchets, which will, of course, cause it to ascend by a regular, continuous, motion.

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21. For a *Cider-press;* Daniel Pride, Potsdam, St. Lawrence county, New York, June 11.

This is a rack and pinion press. Within each cheek there is an iron rack, and two pinions mash into these racks, the pinions being fixed on the ends of a shaft which crosses the press, and the gudgeons of which turn in the cheeks. This shaft carries also two cog wheels, which are operated upon by two other pinions upon a second shaft, above the former. A handspike, or lever, passing into mortise holes in this upper shaft, serves to work the press, and a weight suspended from the end of this lever, will, when wanted, keep up a continuous pressure.

We have never yet found two oak leaves exactly of the same form, and in like manner we may aver that this press does not precisely resemble any other which we have seen; still we are at a loss to tell in what part of it there is any new combination upon which to rest a claim to an exclusive right. The patentee appears to have been in the same predicament with ourselves, as he has not claimed any thing.

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22. For a *Rotary Steam Engine;* David B. Lee, and Stephen Stewart, Philadelphia, June 11.

The principle upon which this engine is to act, is the same which has been tried in a great variety of forms, and always with the same result, namely, that it would go, if well made, but was inferior in operation to the cylinder engine. We cannot give the particular arrangement proposed, without drawings, and deem it sufficient to observe, that a wheel is to revolve, upon the periphery of which there are valves, which shut flush into it, and are to open and be acted upon as they pass through steam boxes, of which there are two, one standing opposite to the other, and each furnished with a steam and escape pipe.

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23. For an HAEMAGALACTIPHORUS, being a new and useful improvement in the *Method of Topical Blood-letting, and Drawing Milk from the Breasts of Women;* David W. D. Houghtaling, M. D. and Andrew Meneeley, Mathematical Instrument Maker, Watervleit, Albany county, New York, June 11.

This instrument consists of an exhausting cylinder, and a cup into which it screws. When applied to the breast, the cup is to be of such size as to receive it, when the raising of the piston will produce a vacuum. The rod, or stem, of the piston has a screw cut upon it, its whole length, and it is to be raised by a thumb screw, bearing upon the cap of the cylinder, which operates in the most gentle manner, and retains the piston in its place. The cup is made double; that is, there is one cup within another, there being a small space,

say $\frac{1}{16}$ of an inch, between them. The inner cup is perforated, all over, with minute holes; the object of this arrangement being to admit of the effect of the exhaustion being felt over the whole surface of the breast. The piston, and indeed the whole instrument, is without a valve.

When a small surface only is to be operated upon, the cup is unscrewed, and the open end of the syringe, with the piston down, is applied over the part.

The claim is to the rod and thumb screw; the double cup, and the application of the open syringe.

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24. For an improvement in *Bedsteads;* John P. Copcutt, New York, June, 11.

A right hand screw is fixed upon one end of each rail, and a left hand screw upon the opposite end; to receive these, plates, with female screws, are let into the posts. The operation is plain, and it undoubtedly was *once* a novelty; when, we know not, but do know that it has been patented more than once.

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25. For a *Washing Machine,* called the "Safe Washer," for the washing of cloths and clothing, and the scouring of the same; Ephraim Wheeler, Galway, Saratoga county, New York, June 11.

Six closely written pages contain a complete description of 'the safe washer.'

"The improvements claimed by the said inventor, to be contained in the machine, are as follows:—

"*First.* The peculiar shape of the sink as applied to the purpose of washing in this machine.

"*Second.* The operation, by pressure, of such a large cylinder, on such small ones as are contained in said machine as described, for the purpose of washing cloths or clothing."

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26. For an improvement in the use of *Flat Boilers for Generating Steam;* Daniel Fanshaw and Horatio Hanks, New York, June 11.

The flat boilers which the patentees propose to improve, are thin quadrangular boilers placed on their edges, with the fire between them. There may, for example, be four such boilers, which have water pipes near their bottoms, connecting them with each other, and steam pipes uniting them together near their upper parts. The water, it is stated, has, heretofore, been forced into one of these boilers, and left to flow into the others through the water pipes. The middle boilers being the most exposed to the action of the fire, have highly elastic steam formed in them, which, by its force, frequently prevents the flow of the water into them, a circumstance pregnant with danger, and preventing the regular action of the engine. The improvement is the forcing of water into each of the boilers indepen-

dently, which is said to obviate all the difficulty heretofore experienced.

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27. For a new *Pegging Machine*, with plates, for making boots and shoes; Nathan Leonard, Merrimac, Hillsborough county, New Hampshire, June 11.

This machine consists of a press to be forced down by a lever. A metallic plate is prepared, in the form and of the size of the sole of the boot, or shoe, to be pegged. This plate is perforated with holes, corresponding with the pegs to be driven. Two other plates are prepared, one of which is furnished with awls, which are to pass through the holes in the first plate, and perforate the sole. The second plate is furnished with metal pins, with flat ends, which also fit into the holes in the first plate. When the boot is properly placed in the press, the perforated plate is laid upon the sole, and secured in its place; the plate with awls is then laid on, and pressed down; when this is removed, a peg is placed in each perforation of the plate, and that which has the pegging pins, with flat ends, drives the whole of them home at one operation.

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28. For an "*Improved Rope Maker*," being a machine for making ropes and cords of all sizes; Stephen Hills, 2nd, Glastonbury, Connecticut, June 11.

(See specification.)

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29. For a machine for *Breaking and Cleaning Hemp and Flax;* Reuben Medley, Bloomfield, Nelson county, Kentucky, June 11.

This machine is intended to operate by horse, or any other suitable power. It has a drum with three beaters, or breakers, formed of strips of wood, defended by plates of iron; after being operated upon by these beaters, the material passes from them between fluted rollers, which meet each other just opposite the edge of the breast beam, upon which the beaters act. Upon the same shaft which carries the drum, and about 2 feet from it, there are lifters which raise a brake, with slats upon its under side, which work between fixed slats below, like the common Dutch brake. Beyond the lifters, knives, about 18 inches long, extend out from the shaft; these knives have dull edges, which work against a spring board, upon which the flax, or hemp, is to be cleaned. The claim is to "the whole of that part of the machine which operates in the breaking of the hemp, or flax."

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30. For an *Improvement in Stoves;* William Naylor, New York, June 11.

This stove is formed in front like a parlour grate, for an open fire, and is to be used with any kind of coal, or with wood; anthracite coal being preferred. Behind the fire there is an oven, boilers, and

other appendages, arranged after the manner of a ship's camboose. The whole seems to us to be compact and well arranged; its appearance, as represented in the drawing, is handsome; its parts, however, are too numerous for verbal description.

Several very excellent cooking stoves have been invented in New York, and this, we think, will add one to the list.

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31. For an improvement in the *Plough*, by which the sides of hills can be ploughed backwards and forwards, throwing the ground always on the same side of the furrow; Philip Altenderfer and Benjamin Altenderfer, Richmond, Berks county, Pennsylvania, June 11.

The specification tells us that "there is a beam with a double mould-board, pointing both ways, but both facing on the same side; two shares, and two coulters, also pointing in opposite directions, the space between the shares being closed, and also the mould-boards closed on the land side. To the above mentioned beam there is another beam [attached] which runs, or rather revolves, upon a pivot in the centre of the first mentioned beam. To the latter beam the handles are attached, and when it is desired to turn the horses, it can be done at pleasure. The upper beam is secured upon the lower by a screw upon the pivot, and by an iron pin at the end to which the handles are attached, which may be drawn out at pleasure whenever it may be desirous to change the direction."

Who was really the "original inventor or discoverer" of this plough, we do not pretend to know, but by turning to page 116, of our last volume, it will be seen that a patent was obtained by a certain John Cromwell, of Maryland, in 1816, for a plough as much like the foregoing, as one pin is like another. We should advise our agricultural friends who wish to buy rights, to deal with Mr. Cromwell, who, as his patent is just expiring, will undoubtedly sell cheap, whilst the Messrs. Altenderfer, having a *new* patent, must be paid accordingly.

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32. For an improvement in the form of *Boxes for the Wheels of Post Coaches, Carts, Wagons, and other Carriages;* called the "Cylindro-conical, Self-wedging, or Self-fastening Box;" Thomas Mussey, New London, Connecticut, June 11.

This is one of those simple and obvious improvements, which, when once presented to us, excites our surprise that it should not have been made long ago. The improvement is upon the form of the exterior of the cast-iron boxes in common use. These have, heretofore, been cast tapering on the outside, as well as within, but in the reversed direction, and they have been so made, because, in this form, the pattern, in casting, would readily deliver from the mould. When thus cast, the smaller, or front box, has its exterior diameter smallest at the end towards the centre of the hub, or nave; the consequence of which, is, that the least start, after it has been driven

into its place, loosens it in every part, and it readily comes out. The larger box, on the contrary, has its larger diameter towards the centre of the nave, and cannot, therefore, be driven into its place, but must, necessarily, be secured by wedges, which are very apt to work out. The patent boxes are made perfectly cylindrical on their outsides, with the exception of a small distance from the end which is first to enter, where they are sufficiently tapered, or chamfered, to prevent their cutting the wood before them. The ears, or projections, which are to prevent the boxes from turning, are made sharp on their inner ends, and, when driven, force their own passage way.

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33. For an improvement in the *Cast-iron Plough;* Jacob Minturn, Urbanna, Champaign county, Ohio, June 11.

This plough looks so much like many others, that it would puzzle an adept in the science of Lavater to discover, from its countenance, any difference in its disposition from many members of the same family. The patentee tells us that "the improvement here claimed, as aforesaid, differing from other ploughs now in use, particularly when the share joins the mould; the mould rests on the share more than twice as high on the left as what it does on the right hand side, so as to form the whole into a regular curve for turning the soil. Also, the hook projecting from the mould, and supporting the hinder part of the share; the mould also differs from others now in use, but which difference I do not claim."

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34. For an improvement in *Spinning Hemp, Flax, Cotton, Wool,* and other materials capable of being wrought into thread, yarn, &c. by means of a machine called the "Spiral Self-supplying Twister;" Walter Hunt, New York, June 11.

This is a peculiar kind of spindle, with its appendages, which appears to be principally designed for the spinning of hemp and flax. We have not, from the drawings and description, obtained a very clear idea of its mode of operation, nor could this be explained without engravings. When a model is received, it may obtain further notice.

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35. For a machine for *Shelling and Cleaning Indian Corn;* John S. Gardner, Canandaigua, Ontario county, New York, June 11.

The corn is to be shelled by passing between a wooden cylinder, with projecting spikes, and a concave segment of a curve, formed of wood, and furnished also with spikes. There are springs to adapt them to each other for the varying sizes of the ears of corn. The corn is to be put into a hopper, and carried to the cylinder by a feeding apron; it afterwards falls upon a screen, which separates the grain from the cob, and a fan completes the cleaning.

There is no particular claim, and although the machine appears to

be a good one, we apprehend that it is not novel in *all* its parts. The first machine for shelling corn, invented upwards of twenty years ago, had a cylinder perfectly similar to the one here described, although it was, upon the whole, a much less perfect instrument.

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36. For an improvement in *Water and Paddle Wheels;* Benjamin Howard, Worcester, Massachusetts, June 11.

This is similar to the wheel for which a patent was obtained by Adolph Heilbronn, of New York, which is described in the present number, with engravings. The difference between them is in the details merely.

The coincidence in the peculiar construction of the wheels is a remarkable one. The priority in the time of application, and in the date of the patent, belongs to Mr. Heilbronn; the originality of invention is a question for others to determine.

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37. For an improved *Plough,* called the 'Diamond Plough;' John Rhodes, Urbanna, Champaign county, Ohio, June 11.

That others may discover where the merit of the invention lies, we give the whole specification, as it is short. All the peculiarity that we perceive in it, is, that the mould board is made partly of iron, and partly of wood; it being widened out at top, by means of the latter material.

"John Rhodes' newly invented plough, differs from other ploughs now in use, as follows: The land-side and share are of wrought iron, and laid with steel; the wing welded to the bar in front, and raised so as to form the principal part of the mould, extending back to the right handle, and fastened to said handle with a bolt and screw; also a piece of wood extending from the sheath to the handle, and fastened either with a screw or rivet, and placed on the top so as to form the balance of the mould; also a bolt with a screw passing through the mould and sheath, connecting them together; the bolt connecting the beam and share together locking in the socket; the coulter being locked on the point of the share, and fastened to the beam on the land-side with a clamp and two screws. This plough may be used with or without a coulter." JOHN RHODES.

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38. For an improvement in the *Application of the Scape Heat from the High Pressure Steam Engine, to the Manufacture of Salt.* For which a patent was obtained October 30, 1827; Alexander Brown, Salina, Onondago county, New York, June 11.

The specification will appear in the next number.

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39. For an improvement in the *Construction of Fire Arms,* viz: Rifles, Muskets, Fowling Pieces, Ordnance, &c.; James Miller, Brighton, Monroe county, N. Y. June 11.

This gun is very similar to that of Rogers, and to Wheeler's (see p. 124.) A revolving chamber, containing seven charges, is placed behind the main barrel. Each of the perforations in this revolving piece has its touch hole, and its percussion priming.

"The improvement relied on in this machine, consists in the simplicity of its construction, every way adapted to hunting, and for war purposes."

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40. For an improvement in the making, or manufacturing, of *Blanks for Checks, Drafts, or Bills of Exchange;* James Atwater, Nathaniel Jocelyn, and Simeon S. Jocelyn, New Haven, Connecticut, June 11.

This is the invention of which a notice appeared in Silliman's Journal, and which notice we re-published in our last volume, p. 145. A new patent, containing some improvements in the former plan, is now about to issue, to the same gentlemen. From the nature of the invention, we shall avoid publishing any particular description of the plan, without the special sanction of the patentees.

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41. For an improvement in *Bellows Tubs, or Cylinders,* for Furnaces, or Forges; Andrew A. M'Pharrin, Huntingdon, Pennsylvania, June 11.

The specification of this patent gives but a confused description of the invention; but the drawing is pretty well executed, and from this it appears that the part called the tub is a single cylinder, having a thick diaphragm in the middle, perforated in the centre, to allow a piston rod to pass through it, and having a double valve, closing a square hole, communicating with each division of the cylinder; between these valves, in the thickness of the diaphragm, a nozzle, or wind pipe, passes out through the side of the cylinder. The piston rod is worked by a crank, connected with a pitman, below the cylinder; upon the rod which passes through the diaphragm, there are two pistons, one above, and the other below it, each piston having a valve opening inwards. It is evident, therefore, that the action of the cylinder, with its double chamber, is analogous to that of the ordinary double bellows, but that it must have the defect of an entire, though momentary, stoppage of the blast at every return stroke. To obviate this, there is upon the wind pipe, a cylindrical chamber, with a weighted piston, to serve as a reservoir for the wind; the loaded piston acting like the upper board of the double bellows. In the wind pipe, there is a damper, which may be closed, or opened, to regulate the exit of the wind.

We do not perceive the superiority of this arrangement, to that of other cylindrical bellows, and are very apprehensive that this patent, like many others, has been obtained by one who is not acquainted with what has been elsewhere done in his own business. The common plan of three separate cylinders, which keep up a continued

blast, seems to us to be altogether superior to the mode here proposed.

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42. For a machine for *Sweeping or Cleaning Chimneys;* Samuel Dow, Elizabethtown, New Jersey, June 11.

There is an elastic rod, made in joints, so that they may be attached to each other as they are passed up a chimney; upon the upper of these there is a block, to which the handles of four, or more, brushes may be fastened, so as to branch off in different directions; these handles are also elastic; the brush part is to be formed of bristles, whalebone, or any other suitable material. Just below the brushes there are attached pieces of iron, which are to operate as scrapers.

The claim is, to "the machine, or broom, in all its parts, as applied to the sweeping and cleaning of chimneys."

From the days of Jonas Hanway, to the present, attempts have been made, particularly in England, to construct a machine to obviate the necessity of 'climbing boys,' and we have no doubt, that upwards of fifty machines for this purpose have been offered to the public; there has been a general feeling in their favour, upon principles of humanity. The one now proposed, strongly resembles some of the earlier attempts in this way; these, however, and many others, with an aspect of greater promise, have been abandoned, in consequence of the impossibility of adapting them to the endless variety in the form, direction, and size of chimneys.

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43. For an improvement in *Bedsteads;* Ebenezer Rogers, and Michael Pearson, Essex county, Massachusetts, June 11.

This *improvement* is similar to Mr. Copcutt's, No. 24, excepting that the right and left handed screws are, as in days of yore, of wood, instead of brass. How each of the two patentees has managed to exert his mental powers on the re-contrivance of this 'modern antique,' it would be difficult to divine, excepting on the supposition, that one of them has invented the *right*, and the other the *left* handed screw, it not being the mode of forming, but the mere application of these screws, which they claim; they say, that "the only thing for which your petitioners would wish letters patent, is the application of the right and left handed screws in the construction of bedsteads."

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44. For an improvement in the *Mode of Crimping Boots;* Thomas Howe, Worcester, Massachusetts, June 11.

A crimping board, similar to that ordinarily used by cordwainers, has the leather placed upon it in the usual way. The crimping board is then applied to the machine, which is the subject of this patent. This machine consists of a frame of wood, having on the upper part of it two jaws, between which the crimping board

is to be drawn. These jaws open and close by means of a screw attached to each. On the lower part of the frame there is a roller, which is to be turned by means of a crank; from this roller two chains proceed, one of which is to be hitched to the top, and the other to the toe, of the crimping board, which has staples attached to it for that purpose. When the board is fixed between the jaws, the crank is turned, and the board and leather are consequently forced down, and the latter crimped; it is then taken out, and permitted to dry.

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45. For a mode of *Applying Heat, by means of Iron Castings* and grates, connected together, and adapted to the uses of cookery, or otherwise, and set in a fire-place; called a 'Fire-place Furnace;' Peter E. Sanburn, Troy, Rensselaer county, New York, June 11.

This is a kind of flat, cast-iron, box, made to fit a fire-place, and having an upper plate, upon the middle of which the fire is to be built. In the centre, just under the fire, there is to be an enclosed iron drawer, in which articles to be baked may be placed, whilst kettles, &c. may be hung over the fire, as in the ordinary fire-place. The ends of this cast-iron box, beyond the centre drawer, have their upper parts formed of bars, or grating, and may have placed upon them any cooking utensil. How these are to be heated from below, we do not perceive.

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46. For an improvement in the *Manufacture of Combs;* John Brown, Providence, Rhode Island, June 11.

It is proposed to make fine toothed combs out of small scraps of ivory, which are of little value; pieces sufficiently large to form one row of teeth, leaving a narrow back to connect them together, answering the intended purpose. Two such pieces, when cut, may be joined by an intermediate piece of hard wood, horn, or any other suitable substance, to which they may be attached by cementing, or otherwise.

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47. For the *Manufacture of Raw or Green Hides, into a Hard and Transparent Material,* suitable for the making of combs, snuff-boxes, lanterns, veneering for furniture, &c.; Samuel Pike, Providence, Rhode Island, June 11.

The process, by which the patentee proposes to effect his purpose, belongs to the class of those, which we think it improper to publish without his consent.

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48. For making *Boxes and Gudgeons, of Cast-iron, Wrought-iron, or Wood,* for saw mills, grist mills, horizontal and vertical wheels, wagons, carts, or any description of wheel

carriage, whether driven by water, steam, horse, or other power; Sullivan Reynolds, Guilford, Chenango county, New York, June 11.

This imposing title precedes a claim to the use of lead for the lining of boxes, or inks, within which gudgeons are to run. This material has been frequently used for the purpose, and in some cases, answers remarkably well, as smooth iron, or steel, runs upon it with but little friction. For very heavy machinery, as for the gudgeons of mill wheels, the loading causes the lead to spread; and in machinery where there is much jolting, or percussion, as in carriages, a similar effect is produced by the repeated blows. Where there is grit, it insinuates itself into the lead, and causes the wearing or cutting of the gudgeons.

We are now speaking of what we have known for more than thirty years; in part from our own practice, and in part from that of others, to whom it was then old.

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49. For a method of *Preventing Bed-bugs from Ascending the Posts of Bedsteads;* James Alexander Cook, Georgetown, D. C., June 13.

A cup and socket of tin is to be placed under each post. This cup and socket is in the form of a flat candlestick, the socket part being sufficiently large to admit the post of the bedstead, and the dish part surrounding the socket, serving to contain, oil, water, or other fluid, over which the vermin cannot pass. A cap like the nozzle of a candlestick, with a rim sufficiently wide to extend over the cup containing the liquid, and prevent the falling of dust into it, is fitted to the top of the socket, or on to the leg of the bedstead. The bedstead must be removed from the wall, and the clothes prevented from touching the floor, when the cups are used.

The claim is to the inner socket, and to the cup. The patentee calls his dishes and caps 'Night Angels.' A name given, we presume, because they are to keep guard at the four corners of his bed, and prevent the approach of the Imps of Satan. The best defence against these nocturnal tormentors, is cleanliness, and those who lack the industry necessary for their destruction, will, we are apprehensive, call in vain, either upon Hercules or Mr. Cook's 'Night Angels,' to protect them from the fangs of these disturbers of their repose.

The effect to be produced by these *Night Angels*, we have repeatedly attained by a *magic circle*, around the lower end of each bed post. This circle was merely a line made with chalk, over which the legion cannot pass. The loose particles upon which they tread, giving way beneath their feet, and precipitating them to the lower regions.

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50. For an improvement in Spinning, called the *Running*

Cap Spinner, intended for spinning cotton yarns, and roping; John Thorp, Providence, Rhode Island, June 11.

(See specification, p. 130.)

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51. For the manufacture of ornamental articles of Furniture, such as *Chandeliers, Lamps, Candlesticks, Mantel Ornaments, &c.;* Frederick B. Merrill, Buffaloe, Erie county, New York, June 13.

Skeletons of chandeliers, candlesticks, &c. are to be made of wire, wood, &c., and these are to be suspended in saturated solutions of alum, or other permanent salts, which crystallizing upon the skeleton so formed, is to supply a cheap substitute for drops, and other ornaments of cut glass.

Ornaments made in this way, are familiar to most of our readers. The chemist has frequently exhibited them to illustrate the formation of crystals to his pupils. Ladies have decorated their mantels, and confectioners their windows, with baskets, columns, and colonnades, resplendent with the tints of the rainbow, by the reflection and refraction of natural and artificial light.

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52. For a *Fork, for Digging the Soil of Gardens, &c.* called a 'Prong Spade;' William H. Norton, Middletown, Middlesex county, Connecticut, June 15.

This fork is to have the general form of a spade; the number of its prongs may vary, but four is preferred. A length of about ten inches, a width of about one and an eighth inch, and an interval of about $\frac{7}{8}$, is also recommended. The fork is to be made of steel, and brought to a spring temper; the prongs may be made rather hollowing on the face, and are to be bevelled from the back, so as nearly to form sharp edges.

This instrument, it is said, may be used in digging with much greater facility than the spade, as it is lighter, and encounters less resistance; it answers the double purpose of the spade and the fork; is not clogged by a wet soil, and may be used around shrubbery and plants, without injury to their roots; it may also be used as a shovel. Such are the advantages which it offers, according to the opinion of the patentee.

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53. For an improvement in the *Mode of Representing the Notes in Music;* William C. Phillips, Lunenberg, Virginia, June 18.

The patentee proposes to substitute for the dots which represent the notes upon the lines and spaces in music, the first seven letters of the alphabet, using capitals, small letters, italics, &c. to designate the value of the different notes. Letters of the same kind may be employed for the semibreve and the minum, with the addition of the

same appendage which now distinguishes the value of those notes, that is, a straight line descending from the letter when used as a minum.

That the notation would be simplified by the adoption of this plan, is, we think, obvious. But in this, as in the reformation of the alphabet, there are two questions at least which present themselves for consideration; can the reformation be introduced? and if it can, will the advantages transcend the disadvantages? Our beautiful and simple system of reckoning in federal money, will fully exhibit the difficulty of introducing new notations, or modes of reckoning. Nearly forty years have elapsed since all the fiscal accounts of the government, and of our merchants, have been kept in this money, and yet at the present day nine-tenths of our monied transactions are in the currencies of the respective states, although it is universally confessed to be an evil, and one, the cure of which would not be attended by any inconvenience.

A new notation in music, like a new alphabet, would have to encounter obstacles incomparably greater than that of our federal money. The written language of music is a universal one, and every musician must be able to read Handel and Mozart, or he may at once determine to "hang up his fiddle." Instead therefore of giving facilities to the learner by a new mode of writing, you absolutely compel him to undertake a double task.

The moral difficulties which interfere with the adoption of such a plan, are, in our opinion, as really insuperable as those physical ones which are the stumbling-blocks of the devisers of ever-moving machines.

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54. For a mode of *Ascertaining the Weight of Goods, or other Loading, in Boats*, or other water craft; Thomas Cohoon, Troy, New York, June 18.

Tubes are to be fixed on the gunwale of the boat, or in any other convenient part. These tubes are to stand vertically, are to be open at both ends, and their lower ends dip into the water. Floats, with graduated stems, are used to ascertain the height of the water in these tubes; these stems having been once graduated by actually loading the boat by tons, or half tons, will ever after indicate the weight of the loading. The floats may be made of any buoyant material, as of cork, hollow balls of metal, &c., and when the load is unequally distributed, the measurement may be taken in different parts of the vessel.

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55. For a mode of *Manufacturing or Forming Hat Bodies of Wool, by Machinery;* Levi Van Hosen, Norwalk, Fairfield county, Connecticut, June 19.

The general principle upon which this machine acts, is similar to that of several others which have been patented. The wool is taken from the doffer of a common carding machine, and wound upon

cylinders with rounded ends, or upon cones, so as to form the bodies. The particular claim in this machine, is to the mode of vibrating the sheet of wool, as it winds upon the former, so as to cross the fibres, and cause them to felt well, and of forming from one to six bodies at the same time, according to the width of the carding machine.

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56. For an improvement in *Canal Passage Boats;* Jacob Bromwell, Cincinnati, Hamilton county, Ohio, June 23.

A moveable roof, forming an awning, is to be constructed above the ordinary roof of a canal boat; this roof is to be capable of sliding down, so as to coincide with the fixed roof, when the boat passes under bridges. To effect this, the standards, or stancheons, which support the moveable roof, pass into hollow columns, or boxes. Weights, passing over pulleys, serve as a counterpoise to the moveable roof, and suffice to sustain it when not pressed down; or the same effect, it is stated, may be produced by springs. There are two pieces of tough hard wood, hinged to the front edge of the moveable roof, and, at the other end, to the bows, or some forward part of the boat; these are to form inclined planes, which, when passing under bridges, are to press the moveable roof down.

The object of the invention, is, the accommodation of the passengers, who, under the protection of this roof, may view the country through which they pass, without annoyance from the sun or rain. They must *look out*, however, in passing bridges, or the roof may prove a "dead fall." It may be well to recollect the poor Frenchman, who, when the captain of a canal boat cried "look out," as they approached a bridge, nearly suffered decapitation by literally obeying the order.

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57. For a mode of *Cutting out Boots and Shoes*, by means of a scale, or graduated pattern; Samuel Marshall, Philadelphia, June 23.

The pattern used by Mr. Marshall, is usually made of copper, and bears a strong resemblance to that for which a patent was obtained by Mr. Thomas Howe, of Massachusetts, on the 18th of April, as noticed in our last number. It appears highly probable that both these gentlemen have adopted analogous modes of procedure, independently of each other.

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58. For a *Cooking Stove* for burning Lehigh, and other hard coal; Cornelius Schermerhorn, New York, June 23.

Judging from the drawing and description, we should think this stove well adapted to its purpose. At all events, it is distinctive in its character, the structure of the stove, and the management of the fire, differing essentially from every other which we have seen.

The body of the stove is a rectangular iron box, closing in front with folding doors. This box contains a sliding grate, or furnace. In the drawing accompanying the specification, the grate is repre-

sented in the form of the ordinary Lehigh coal grate, with open bars in front. The box in which the grate is contained, is in length and height just sufficient to receive it, but in depth, from front to back, about three times that of the grate. A bar, or rod, projects forward, by means of which the grate, which slides upon ledges, may be drawn forward, or pushed towards the back of the containing box. The top of the box, in front, is perforated to receive boilers, &c. under which the grate may be drawn, whilst at the same time roasting may be effected in front of it. The back half of the box is surmounted by an arched oven, formed of double plates, to allow a passage to the escape pipe. There are sliding dampers, and other appendages, which appear to be ingeniously contrived and likely to operate well, but which we shall not attempt to describe.

The claims are to "the sliding furnace acting directly on the boilers, and all parts of the oven; and likewise the ventilators, preventing a too intense heat upon the bottom of the oven plate; also the portable slide, or damper, and the construction of the double flue."

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59. For an improved *Churn;* Abner Murray, Athens, Bradford county, New York, June 27.

This churn is to stand vertically; its dasher consists of one flat board, revolving on gudgeons, and reaching each way, to within two or three inches of the sides of the churn. Stationary slats are fixed within the churn, extending from the bottom to the top; they are fastened by one edge to the staves, and are sufficiently wide to reach within half an inch of the dasher; of these slats there may be two, or more. The upper gudgeon of the dasher passes through the top of the churn, and has on it a bevelled wheel, which is turned by a second bevelled wheel, fixed upon a horizontal axis, and moved by a crank.

The claim is to the "placing from two to five slats, or breaks, perpendicularly, at equal distances apart, inside of the churn, to set between the joints of the staves, standing edgewise, towards the centre of the churn."

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60. For an improvement in manufacturing and *Ornamenting of Combs;* Ebenezer Mustin, Philadelphia, June 27.

This improvement in the *manufacturing* and ornamenting of combs, consists in drawing any device, or ornament, upon the tops of combs, with gold size, and the laying on of gold, silver, or other leaf, or bronze. This process is the same that is practised upon chairs, and an infinite variety of ornamented articles; the *invention*, or *discovery*, therefore, consists in doing that upon combs which has in itself no novelty whatever. The whole specification might have been comprised in the words, "I claim a patent for ornamenting combs by gilding." Query, is this "a new and useful improvement on any art, machine, manufacture, or composition of matter, not known or used before the application?"

61. For an improvement in the mode of *Making Cloth by Machinery;* Henry Raymond, New York, June 27.

There is in Mr. Raymond's specification, a very exact description of the machinery which he employs in manufacturing cloth by felting, without spinning or weaving. We have recently had occasion to notice some patents which have been issued for the same purpose, and have adverted to former attempts of the same kind. Besides the present claimant, it will be seen that patents bearing the same date, have been obtained by Mr. Van Hosen, of Connecticut, and Messrs. Peck and Taylor, of New York.

The revival of this plan for manufacturing cloth, has, we have no doubt, been suggested by the machines now so extensively used in the manufacture of hats, in which the wool is taken from the carding machine on to a conical former, for the purpose of felting.

The essential parts of Mr. Raymond's machine, are, a wool carding machine, and a roller fixed upon a carriage, which traverses in front of the doffing cylinder. In the machine described, the cylinder upon which the bat of wool is to be received, as it is delivered in a sheet from the carding machine, is five feet in length, and three feet in diameter. As the carriage which supports it traverses in front of the doffing cylinder, and in the direction of its axis, the wool alternately crosses the preceding layer. A second, and smaller cylinder, or roller, rests on the periphery of the large one, and, by its pressure, slightly consolidates the layers of wool, and prepares it for felting. A cylinder of this size will afford a piece of cloth of about five by nine feet, but this may be varied according to the size of the machinery. The particular mode in which the large cylinder is made to revolve, and its carriage to traverse, it is not thought necessary to describe.

The claim is to "the above method of forming cloth webbing, of wool, or of any other material which has felting properties, by the use of the carriage and two cylinders, made to perform the above mentioned motions."

It is stated, that "upon this plan of operation cloth may be made of any desirable length and width, and suitable for carpets, blankets, rugs, gentlemen's wear, and other purposes, in greater perfection, with more despatch, and less expense, than by any other method; and the machinery is easily kept in repair."

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62. For a machine for *Making Felt of Wool* without spinning or weaving; Levi Van Hosen, junr., Norwalk, Fairfield county, Connecticut, June 27.

Although the object of this patent is the same with the last, the manner of effecting it varies in several particulars. Instead of one carding machine, there are three, one of them of four feet, and two others of two feet in width each. The sheet of wool as it comes off the four foot machine, passes upon an endless cloth, which hangs down through the floor of the manufactory, into the apartment below, and extending in length about twelve feet. The wool from the

two narrower machines is in like manner received upon endless cloths, having their planes at right angles with that of the wider cloth. The wool passes below on to a frame called the felting machine, upon which the wider web is laid. This frame has a vibrating motion, for the purpose of carrying it backwards and forwards under the wool delivered from the narrower machines, causing their fibres to cross those from the wider machine at right angles. This it is made to do on both sides of it, until there is sufficient thickness to form the felt. Thus the wool from the four foot machine may be compared to the warp, and the others to the filling; the warp being in the centre, and the filling on each side of it. "The felt after it acquires sufficient thickness for use, is received between two cylinders about six inches in diameter, which are put in motion by gearing on the other end of the frame. The felt passes between two cloths, which revolve by the same gearing which draws the felt, and the first process of basoning is produced by cylinders which revolve and generate steam." [? How?]

"What I claim, is the mode of setting up the felt in the piece, and crossing the wool like warp and filling, directly at right angles, by laying the warp in the centre, and the filling on each side of the felt."

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63. For *Manufacturing of Cloth* without spinning and weaving, and by crossing the wool; Nehemiah Peck and Daniel Taylor, New York, June 29.

The machinery proposed to be used by Messrs Peck and Taylor, is essentially the same with that of Mr. Raymond, and their applications were, therefore, viewed as interfering. This was represented to the parties, between whom a compromise was consequently made; it being agreed between them that both patents should issue, the interest of each having been adjusted in a way which was mutually satisfactory.

Messrs. Peck and Taylor claim the combination of the machinery described by them, and its application to the crossing of the wool, either separate, or with cotton or hair, for the purpose of making blankets, table-spreads, and other kinds of cloth. Also, the principle of crossing the wool, cotton, or hair, by machinery; likewise, the use of one or more carding machines, placed in a row, or at right angles; and their mode of hardening and fulling the cloth, as described in their specification.

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64. For an improvement in the *Printing Press*, for which a patent was obtained on the 8th of February, 1819; John J. Wells, Hartford, Connecticut, June 29.

The press is one of those in which the power is obtained by causing a lever, acting horizontally, to operate upon two others, which form what is usually known under the name of the *toggle joint.* The improvement made is in the mode of connecting these moving parts.

65. For a *Power Windlass;* William Pennell, Brunswick, Cumberland county, Maine, June 29.

Two cog wheels, and two pinions, which act in the manner of the common double geared windlass for raising weights, constitute this machine; the axles upon which the pinions are formed, are turned by common cranks, or by handspikes.

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66. For an improvement in the construction of *Steam Boilers;* Francis Coffin and Charles C. K. Beach, Boston, Massachusetts, June 29.

(See specifications.)

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67. For a new and useful machine for *Fastening and Securing Window Shutters;* Truman Bartholomew, New York, June 30.

This *machine* consists of two latches, and two catches, one pair of them to fasten the shutter, when open, against the wall, the other to secure it to the sill when closed. A particular description we should deem superfluous, as the contrivance possesses no great novelty. It will, undoubtedly, answer the purpose equally well with fifty others, patented and unpatented, which have been offered to the public, and probably better than several of them.

Specifications of American Patents.

Description of an Improved Wheel with Revolving Paddles, applicable to the propelling of Ships and other floating bodies. Patented by Adolph Heilbronn, *New York, March 16th,* 1829.

(with a copper-plate.)

In the patent of Mr. Heilbronn, several different improvements in navigation are described and claimed; in the present article, we shall explain the first of them only, but shall hereafter present the others, having a plate prepared for that purpose.

These various inventions have been perfected in conjunction with a gentleman in England, where a patent has also been obtained for them.

The revolving motion given to these paddles, differs altogether from that which has been contrived with a view to their dipping into, and emerging from the water vertically. The paddles, or buckets, in Mr. Heilbronn's wheel, are each fixed upon an arm which radiates from the centre of the wheel, as may be distinctly seen by a reference to the engraving.

In a wheel so constructed, the paddles may be made to enter the water edgewise, and be turned, so as to act upon it at any point which may be preferred. The paddles which are out of the water, are all feathered, or turned edgewise, so as to experience but little

resistance from the wind, and to require a very shallow box or casing, to protect them on each side of the boat. A wheel of this description may be immersed in water to any depth which may be required; or it may be entirely under water, where the depth is sufficient; should such a mode of fixing it be thought adviseable, the progress of the boat will be but little impeded thereby.

One great advantage anticipated from these paddles, is the avoiding of those numerous and perpetual concussions produced by the striking of the water by the ordinary floats, which causes a continued, distressing, and very injurious tremulous motion. They enter by their edges, and are gradually brought into action.

The number of revolving paddles to be used, will be best determined by experiment.

Figure 1, plate 2, represents one of the said wheels of eight arms or paddles, as it appears when in a finished state, and as applied to the side of a vessel; and figure 2 is a view on a larger scale of the central part of the said wheel, as seen from the opposite side, or that nearest to the vessel, for the purpose of showing how the paddle-arms are held and supported in their places, and yet permitted to turn or feather at the proper instant, while the whole wheel turns round; and figure 3 is a section of the same part of the paddle-wheel, as is shown by figure 2, and likewise of the piece G G, which is called the wiper carriage, which is immoveably fixed to the side of the vessel, for the purpose of producing the turning or feathering of the paddles at the proper moment. In these several figures A A A A, is a circular disk or plate of cast-iron, having a rim or ring B B B, rising on one side to a sufficient height to give strength and solidity to the said circular plate, and also to take the brasses C C C, through which the paddle-arms or axes D D D D, are permitted to turn. The central block of metal E may be cast in one piece with the disk or plate, but will be better detached, and afterwards fixed to it by screw bolts, as shown in the section figure 3, because when detached, the brass sockets, or steps *a a a a*, for receiving the inner ends of the paddle-arms or axes, can be more accurately bored and fixed. The disk or plate A A A A, with its centre block E, forms the central part of the paddle-wheel, which must be firmly keyed, or otherwise fixed upon the main shaft F F, which derives its rotary motion from any power applied within the vessel, and this shaft also passes freely through the centre of the metal wiper carriage G, which is firmly and immoveably fixed to the side of the vessel, for the purpose of operating upon the wipers or projections *b b* of the paddle axes, in order to produce the turning or feathering of the paddles. To effect this, the outer face of the wiper carriage presents two annular surfaces, as seen at *c* and *d* in figure 4, (which is a front view of it,) and a part of one of them is cut away as at *e e*, to a greater or less extent, according to the period at which it may be desirable to make the paddles turn or feather. The wipers or projections on the axes of these paddles are projections of steel or other metal, crossing each other so as to project at right angles from the axes of the paddles, and as these wipers come into contact with one or other of the

annular surfaces *c* and *d*, figure 4, and also seen in figure 2, the several paddle axes will each make a quarter turn or revolution. Thus the five wipers *z z z z z*, figure 2, lie with their flat surfaces upon the annular surface *c* of the wiper carriages, but that surface is cut away between *e* and *e*, (as is more distinctly seen in figure 4,) and the inner annular surface *d* then presents itself, and acts upon the wipers *z z* to turn them round; consequently the inner wipers *y y y* will now assume the flat position, and will continue in it, until they are again brought by the motion of the wheel, into contact with the ends of the outer annular surface *c*. It will thus be seen, that by enlarging or contracting the opening *e e*, figure 4, and with it the inner annular surface *d*, that one, two, or more, of the paddles may be made to stand at right angles to all the rest, and thus that any number of paddles may be made to move through the air, and to enter into and come out of the water with their thin edges forward, while the remainder, or those that are under the water, will remain steadily in that position in which they are most effective for the purpose of propelling, as is distinctly shown by the manner in which the paddles are arranged round the wheel, as shown by figure 1. It will be necessary to employ springs to prevent the blow and concussion, which would otherwise take place between the wipers on the axes of the paddles, and the ends of the wiper carriage upon which they strike, and by which they are turned round; and the best application of such springs, is to use those of the spiral kind, of considerable strength, and to introduce them into round holes very nearly fitting them, and drilled in the ends of the wiper carriage which first comes into contact with the wipers. The spring being introduced into the hole, a cylinder of hard steel just fitting the hole is placed upon it, and there fixed by a pin driven through a chased mortise hole in the said cylinder, in such manner that the said cylinder can fall wholly into the said hole when pressed upon, but without such pressure, will project about half an inch or rather more out of the said hole; and as the said wheels are so fixed as to require cases to protect them, as in ordinary steam-boats, such cases may be formed of light iron work, covered over with slight iron bars, or with strong wire work, because such open work cases do not offer the same resistance to the wind and water as close boarded cases do; and moreover, they have the effect of much more effectually breaking the force of the waves when they drive against them. Bars or rods with points upon them are also fixed to the insides of such cases, causing the said points to come as nearly as possible to the paddles and paddle axes without touching them, for the purpose of clearing off any weeds that may attach to the paddles, and likewise to protect them from striking against any timber, ice, or other floating substances, by which the paddles of steam-boats are frequently broken or injured.

The claims of the inventor, in the paddle wheel and its appurtenances, are, First, to the frame work, or wheel, as above described, for holding the patent paddles. Secondly, the introduction of springs to act upon the wipers. Thirdly, the paddle box made of open wire-

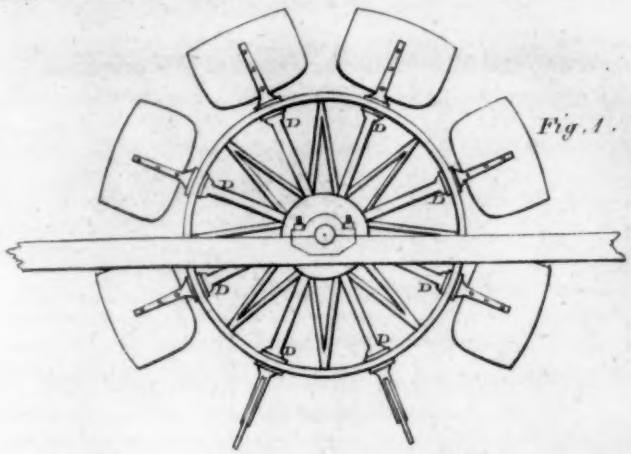


Fig. 1.

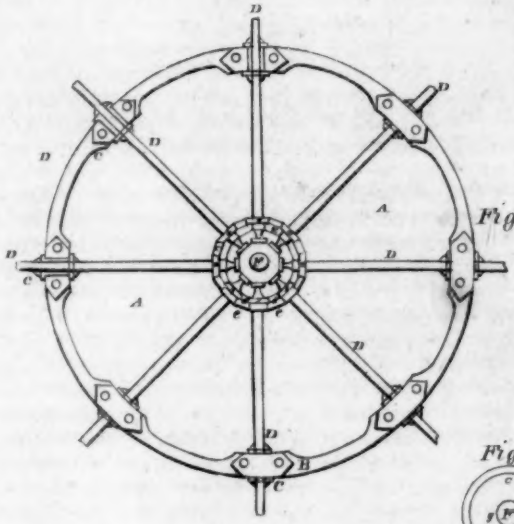


Fig. 2.

Fig. 4.

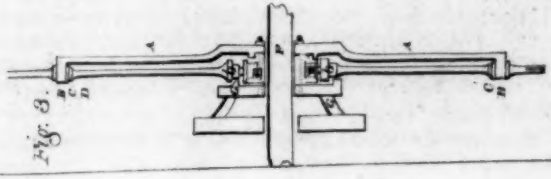


Fig. 3.

work, net, or cross bars, with projecting pieces, or points, to clear the paddles.

Experiments are now in progress in New York, for testing the value of the foregoing machinery. The trials hitherto made have been attended with satisfactory results; but experience teaches us to suspend a final judgment until the thing is fairly tested, in a vessel of the ordinary size.

Description of a Revolving Boiler for Steam Engines, invented by FRANCIS COFFIN, *and* CHARLES C. K. BEACH, *of Boston, Massachusetts. Patented June 29th,* 1829.

A CYLINDER of iron or copper, is made of such length and diameter as may be determined upon; a second cylinder of the same length, but two, or more, inches less in diameter, is placed within the first, and a hoop of metal inserted at each end, to fill the space between the two. This hoop is rivetted, and made steam-tight, and a space of one inch, or upwards, is, of course, left between the two cylinders. This space is to be kept full of water, for the supply of the revolving boiler, that is to be contained within the outer case, which the patentees denominate the heater.

The heater may vary in its form; it is intended sometimes to make it egg-shaped, and to increase the space at the upper part, so that in a transverse section it would be somewhat in the form of a new moon. A boiler of this kind may be constructed without being enclosed in brick work, and is particularly adapted to steam-boats.

Through the top of the heater, two, or more, perforations are made, for the passage of smoke and flame from the fuel. Cast-iron heads are made to close the circular ends of the heater, and in these there are man holes, and such other openings as may be necessary. A cylindrical boiler is placed within, and extends the whole length of the heater; this boiler is supported upon hollow gudgeons, which proceed from the centre of each of its heads, and pass through suitable openings in the iron plates which close the ends of the heater. Upon these gudgeons the boiler is made to revolve. For this purpose they rest, when the boiler is full, upon the openings in the heads of the heater; but as one of the ends is, to a certain extent, susceptible of being elevated and depressed, the opening in the head through which the gudgeon passes is lengthened upwards, the gudgeon, or rather the pipe which passes into it, resting upon an apparatus, to be presently described.

Under the boiler is a furnace, and ash pit, built up with brick work, in the manner of other cylindrical boilers.

By means of a force pump, the heater is kept constantly filled with water, and from this it passes into the boiler through one of the hollow gudgeons. Through the other gudgeon the steam escapes to supply the engine. One of these gudgeons is, we have said, capable of being elevated and depressed. This is effected by a lever with a

long and short arm, which extends horizontally over the boiler. The short arm is connected to the gudgeon of the boiler, which is capable of elevation; and upon the long arm is hung a weight, which is an exact counterpoise to the weight of the boiler, and the contained water, when sufficiently filled. When the quantity of water diminishes, the weight on the lever preponderates, and this, by a proper connexion with the force pump, increases the stroke of the latter, and consequently the supply of water.

Instead of the heater before described, it is proposed sometimes to surround the boiler with metal tubes, running longitudinally with it, having connecting pipes at their ends, to convert them into a continued tube, into one end of which the water is forced, whilst from the other it passes into the boiler, through its gudgeon, as from the heater. These tubes are kept in their places by resting on hollows in the cast-iron furnace heads, and are surrounded by the arched brick work of the furnace.

The boiler is made to revolve by the motion of the steam engine, a toothed wheel which carries it being secured by screws on to one of the gudgeons. By means of proper gearing, the rapidity of the revolution is placed under the command of the engineer.

"The heater is always full, but it is obvious that the boiler, continually revolving, requires but little water, say from $\frac{1}{20}$th to $\frac{1}{10}$th of its capacity, thus leaving almost the whole of it for steam-room.

"The boiler containing so little water, is heated in a few minutes, whereas, in the common boiler, the body of water is so great, that it requires a very long time to get up the steam, and at a great expense of fuel.

"The danger of bursting, in the common boiler, from being unequally heated, and from the great body of boiling water within, is justly considered imminent. The revolving boiler is always equally heated, and the volume of water, being comparatively nothing, the danger is proportionably decreased.

"What we claim as new, in the foregoing specification, as being of our inventions, are:

"1st. The revolving boiler, as entirely new and hitherto unknown; and we claim the exclusive use of it, with or without the heater, and with or without the pipes; it being, in either case, much superior to any known method of generating steam.

"2nd. The heater, which surrounds the boiler, and supplies it with boiling water.

"3d. The pipes answering the same purpose as the heater.

"4th. The manner of suspending the boiler at one end, by which contrivance it feeds itself."

Some account of various improvements in Rail-roads and Rail-road Carriages, invented by Isaac Knight, *of Baltimore, Maryland. Patented June* 11, 1829.

The specification accompanying this patent, is so extremely excursive in its views, so immethodical in its arrangement, and so indefinite in its claims, as to render an analysis of it extremely difficult. We have, therefore, taken it up, and given a short abstract of its contents, in the *order* in which they stand.

The proposed rails are to be of wood, about $2\frac{1}{2}$ inches thick, and ten inches deep; these are to be covered with bars of wrought iron of the exact width of the thickness of the rails; the wheels of the carriages are to have double flanches.

In passing over vallies, long posts of wood may be used to receive the rails; pillars of stone, or chairs of cast-iron, may be employed when the depth is not too great. The joints where the rails are let into the posts, may be secured by coverings of tin, sheet lead, &c. The pillars must be framed together by cross-ties and braces, where the elevation is considerable. The horse path is to be formed of plank, where the depth is too great to fill with stone or gravel.

The two flanches upon the wheels, it is calculated, will tend to keep the rails from losing their parallelism. It will be evident, however, that if they effect this object, it must be at the expense of great friction, yet these flanches are depended upon to prevent the necessity of cross-ties.

It is said, that case-hardened friction wheels should be used, and that they should rest upon the main axle of the travelling wheels, which should likewise be case-hardened. A particular mode of fixing the framing for these is recommended.

It is proposed to fix seats for passengers along the sides of the carriage, which seats may project over the wheels. There is also to be a dining table, and other accommodations, such as stoves, a kitchen, glass windows, stairs, &c. which are all proposed as parts of the establishment.

The mode proposed of adapting the carriages to curved roads, is very similar to that of Mr. Howard, and also to one included by Mr. Knight in a former patent.

Masts and sails may occasionally be used, to take advantage of the wind, when fair. By means of ropes, or endless chains, passing over pulleys, these carriages, it is said, may be made to draw others against the wind.

There is here a general claim to the foregoing principles and combinations, and a specific one to the manner of placing the wooden rails upon the tops of the posts. The particular form of these wooden rails. The application of the double flanched wheel running upon flat bars of iron. The mode of covering the posts to protect them from the weather. The mode of fixing the friction wheels, and using smaller ones to prevent lateral friction.

The patentee intends also to protect the posts where they enter

the ground, by filling round them with small stones; to pave round them with flat stones; and to cover the whole with tar and sand.

The mode of bridging described, is next claimed; also a cheap plan of branch rail-roads; also a mode of embarking wagons, and landing them from boats, by means of a windlass; also the invention of a *shifting carriage*, to run on lateral, or branch roads, upon which shifting carriage the loaded rail-road carriage is to be conveyed; to a double inclined plane, or rail-way, running on two sets of rails, one over the other, for the purpose of removing earth, &c. to small distances. Also a mode of connecting ropes and pulleys for one carriage to descend, and another to ascend, an inclined plane. To a double rail-way, one above the other; and to a mode of travelling both ways on a single track. To the covering the wood under the rail, and at the joints, with sheet metal, and bending it down to prevent injury from wet. There are likewise several intervening claims which we have omitted, in order to shorten this article; but the next is to a whole newly contrived carriage, which has been figured and described in many of our public papers; the following may give some idea of it.

A horse is to be placed upon a moveable endless floor revolving upon rollers, and these are to give motion to the main wheels of the carriage; they may be so geared together, that if the horse travels at the rate of two miles per hour, the carriage may go ten. This is particularly described.

After this comes another mode of protecting the posts, which is claimed. The post is to be bored longitudinally, and the hole filled with oil, or salt, or a mixture of both, and plugged up. The outside is then to be painted with white lead, to be covered with sheathing paper, or cloth, saturated with proper materials, or to be covered with sheet metal.

There are in the above so many items, that we cannot attempt to animadvert upon them; the patentee has made a complete rail-road and rail-road carriage analecta: it is, however, fairly to be apprehended, that a number of his claims will be disputed by other inventors; and indeed this has been already done. Some of the claims appear to be for intended improvements, which are now patented in anticipation, and several others, we suspect, will not fulfil the averment that they are *new* and useful. Admitting, however, that every thing claimed is new, useful, and original, the question may fairly be asked, whether there is a sufficient connexion in all the things claimed, to make them properly the subject of a single patent. Half a dozen new machines, or improvements upon half a dozen old ones, can scarcely be included under the terms a "new and useful art, machine, manufacture, or composition of matter."

Specification of a patent for an "Improved Rope-maker." Granted to STEPHEN HILLS, 2nd, *Glastonbury, Connecticut, June* 11, 1829.

THE size of the machine may be varied, according to the bigness of the rope, rigging, or twine, to be made. That for common rope,

or rigging, is about six feet square, on a frame. On one end are three spindles standing perpendicularly, with spools and flyers attached to them, and driven by a belt, or gear. On the opposite side is one spindle standing also upright, with spool and flyers driven by a belt or gear, cross banded, or contrariwise from the three first mentioned spindles; this takes up, with a heart motion, the rope, or twine, as fast as laid. All the spindles are moved by a horizontal wheel in the centre of the machine, and may be turned by hand, horse, or water power. Three threads pass between two rollers placed above the wheel, from the three first mentioned spindles, and pass from thence to the one spindle mentioned last as standing alone.

The great advantage of this machine, is, that any kind of rigging can be made in a room sixteen feet square; and this supersedes the necessity of rope-walks; it also makes the material better and faster than the common mode, and it consequently can be afforded at a cheaper rate.

What I claim as new, and as my own invention, and for which I demand an exclusive privilege, is the whole machine as applicable to the above purposes. Stephen Hills, 2nd.

Specification of a patent for an Iron Mill, for grinding various articles. Granted to John W. Post, *of Washington, D. C. and* Calvin Post, *of Springport, Cayuga County, New York, April 11th.*

The grinding part of this instrument is made either of wrought or cast iron, or of steel; it consists of two parts, one of which moves within the other. The outer part may consist of one solid piece, or of sections, forming a conical tube. The inner part corresponds with the outer. On the grinding surfaces of each are either spiral, perpendicular or cross threads, projections, or furrows, increasing in number, and decreasing in depth, as they approach the vent of the mill. The threads on each may run parallel, being of any inclination required. The inner grinder moves, and the outer one remains stationary, it being unnecessary that more than one of them should move, although both of them may be made to move, if thought necessary. The lower part of the inner grinder terminates in a pivot, or point, which stands in a cup on a piece of timber, and is raised and lowered with the timber, to set the mill for grinding coarser or finer, by means of screw-bolts and nuts; the bolts passing through the timber which supports the outer grinder.

The upper part of the inner grinder terminates in a shaft, or gudgeon, on which is fixed a long pinion capable of rising and falling with the grinder, from three to eight inches, and still remaining in mash with the driving wheel.

The leading principle of this improvement consists in having the least possible diameter of the grinders at the upper or feeding end; great length and as little increase of diameter at the bottom, or vent, as will merely admit of setting the mill for grinding coarser, or finer.

For a hand mill, the upper, or feeding end, is required to be little more than one inch diameter, and the lower end, or vent, two inches, being two, or more, feet in length, and uniformly tapering from the top to the bottom. By this form and construction the greatest possible mechanical leverage and power is obtained; the mill may move with great velocity, the grain, or article, being introduced as nearly as possible at the fulcrum, or centre of the shaft or grinders, and continuing near the centre until it is discharged, almost any resistance is easily overcome.

For grinding corn with the cobs, bark, apples, or any other coarse article, the upper part of the outer grinder has a funnel top, which contracts gradually in its capacity for a short distance; after which it is continued with a small and uniform increase of diameter, as described in the mill for grain, and other small articles; the whole being three feet in length.

In grinding corn with the cobs, bark, or other coarse articles, the mill may first be set coarse, and after the corn is shelled from the cob, and the cob broken, or the article rendered finer, the mill may be set finer, and the grain, or article, passed through a second time.

For the hand mill, the pinion, which has already been mentioned, may have from ten to twenty cogs; and the driving wheel, which is a faced cog-wheel, may have from fifty to a hundred cogs; to which may be connected, either on the same piece, or on the same shaft, a fly-wheel, all moved by a crank.

For the horse mill, a whorl, instead of the pinion, may be used, receiving a strap from a large horizontal wheel upon a vertical shaft.

Either of the forms of the grinder may be used for breaking grain, or other articles, preparatory for the common flour mill, to which it may be either mediately or immediately connected, as circumstances may require.

Mills may be constructed upon this principle, consisting in part or altogether of stone. The lower part may be stone, so as to make flour of the article ground.

What we claim as new, and as our own invention or discovery, in the above described mill, and for the use of which we ask an exclusive privilege, are, the grinders, as above described, and the mode of regulating the mill both for hand and other power.

JOHN W. POST.
CALVIN POST.

FRANKLIN INSTITUTE.

THE twenty-second Quarterly Meeting of the Franklin Institute of the state of Pennsylvania, for the promotion of the mechanic arts, was held at their hall on Thursday evening, the 16th July, 1829.

THOMAS FLETCHER, Esq. Vice President, in the chair, and WM. HAMILTON, was appointed Secretary pro tem.

The minutes of the last quarterly meeting, and also of the special meeting, were read and approved.

The chairman of the committee of investigation on the subject of water wheels, reported that the committee still continued to receive subscriptions towards defraying the expenses of the experiments; the amount fixed by the committee as necessary to be raised previous to commencing the operations, is now almost made up; the committee had hoped that the sum would have been received at an earlier date, but that has been prevented, entirely by the general depression of business among that class of citizens who are most immediately interested in the results of the experiments. The committee now believe that such an amount will shortly be subscribed as will justify them in making a commencement, and as it is of the utmost importance to extend their inquiries as far as possible, they hope the members of the Institute and others interested, will still continue to exert their influence to increase the amount of the subscriptions.

The quarterly report of the board of managers was read and accepted.

THOMAS FLETCHER, *Vice President.*

WILLIAM HAMILTON, *Secretary pro tem.*

The Twenty-Second Quarterly Report of the Managers of the Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts.

THE board of managers present a report of their proceedings since the last quarterly meeting of the society, in accordance with the regulations and laws of the Institution.

In addition to the regular courses of lectures on chemistry and mechanics, to be delivered during the ensuing season, arrangements are now making by the committee of instruction, for the delivery, during the whole period allotted, of volunteer lectures, varied in their character, and of manifest utility.

The board would respectfully call the attention of mechanics and others to the subject of the delivery of volunteer lectures. They are the sources from which much good will flow, a large portion of valuable and interesting information be diffused, and thus serve in a great degree to keep alive the interest in, and extend the influence of, the Institute.

At the close of the present quarter of the High School, the course of instruction originally contemplated in that department, will have been completed. Since its organization, and during the whole term of three years, the board have been gratified with the flattering reports which have been received from the committee on instruction. It has received an unusually large share of the public patronage, and it has been instrumental in an eminent degree in diffusing the blessings of education, and in elevating the character and standard of instruction in the community, more especially in the introduction of a well digested and more complete system of text books than have heretofore been used in the schools in this city. The school will be continued in the Hall of the Institute, under the direction of the present principal, W. R. Johnson, A. M., assisted in the several branches by instructers of acknowledged reputation.

The board of managers would beg leave also to report, that a special committee has been appointed to make the necessary arrangements for carrying into effect the resolution of March 12th, 1829, in relation to the very interesting and important subject of ascertaining "the value of water as a moving power, and the relative effects produced by it on water wheels of different constructions."

The committee have been zealously endeavouring to raise the sum required to carry on the experiments contemplated, and have succeeded in obtaining a large proportion of it. The board rely with great confidence upon the assistance and exertions of the mechanics and manufacturers of the United States, to aid them in the investigation of a subject so valuable and important in the results to be produced, not only to themselves, but to the country generally.

Agreeably to a resolution passed at the last quarterly meeting, monthly meetings of the Institute have been regularly held on the fourth Thursday of each month, upon the plan described in the last quarterly report. It is believed that the results anticipated, have been produced by the adoption of this popular measure. Subjects of interest and practical utility have been presented and discussed, the library of the Institute has received considerable and important additions, the cabinet of minerals has been enlarged by donations presented at these meetings, and the board view their continuance as calculated to promote the object and interest of the Institute, and recommend the attention of the members to them.

By a resolution of the board, it was decided that the next exhibition should be held in the year 1830. This measure was adopted after mature deliberation; and it is believed that exhibitions held every two years, will excite more interest, and will be productive of more advantage to the arts and manufactures than annual ones. The committee on premiums and exhibitions are actively engaged in making arrangements for an exhibition at that time, which it is expected will not be inferior to any of those heretofore held, and which will exhibit the state and progress of the mechanic arts in our country.

HENRY HORN, *Chairman.*

WILLIAM HAMILTON, *Actuary.*

Monthly Meetings.

IN the twenty-first quarterly report of the managers of the Franklin Institute, (p. 291, vol. 3,) was given the plan of monthly meetings of the members, for the reading of papers, and the discussion of questions connected with the objects of the Institution. Several of these meetings have been held, and should they be continued with the spirit which has attended their commencement, they cannot fail of producing the most beneficial results.

The paper in the last number, on the subject of "Friction, and the Power of Heavy Bodies in Motion," emanated from that source, and we anticipate the reception of a sufficient number to occupy a

separate portion of the Journal every month. It is generally understood that an editor is not responsible for the opinions advocated by his correspondents; nor is it to be considered as his duty to undertake the invidious office of censor, although it is his right, at all times, to express his opinion. In discussions of the nature of those of which we are now speaking, it will be proper to allow an unusual latitude, as in such a case "error of opinion may be" advantageously "tolerated, whilst reason is left free to combat it."

For ourselves, we shall always prefer those papers which are upon practical subjects, as we consider one experimental truth to be of more value than a thousand ingenious theories; and these truths many of the gentlemen concerned are eminently qualified to make known. We say not this to damp the ardour of those who are anxious to inquire into *causes*, and should regret exceedingly to learn that our remarks had had the effect of suppressing the ingenious speculations of those who are seeking "admission behind the scenes."

Observations on the Hardening of Steel. By RUFUS TYLER, Mechanician, *Philadelphia.*

TO THE FRANKLIN INSTITUTE.

The following remarks on the subject of hardening steel, are offered to the Institute as the result of much experience in the regular course of my business, and of essays suggested by some peculiarity, accidentally noticed, and made for my own satisfaction. It is, perhaps, to be regretted, that I have not had leisure to repeat them with a view to greater accuracy of detail; by some, however, this may be deemed a favourable circumstance, as they are not fortified by any array of numbers, or formulæ, and may, therefore, be the more readily discussed, corrected, and amended, for which I am fully aware my best endeavours leave ample room.

The peculiar kind of hardening of which steel is susceptible, depends upon two conditions: first, *a sufficient degree of heat*, (somewhat above the lowest red,) which may be termed the hardening heat; and second, *sudden cooling*. A deficiency of only a few degrees of heat, or an excess of two or three seconds of time, beyond certain limits, will *entirely* defeat the operation.

The usual method of hardening steel for common purposes, is to heat it to the proper degree, (the lower the better, provided it be not so low as entirely to fail to harden,) and then to plunge it suddenly into cold water. When it is requisite to protect the surface from the corroding effects of the atmospheric air, as in engravings, dies of delicate workmanship, &c. it should be imbedded in fine charcoal powder, previously heated to redness, in an iron box, to drive off the evaporable matter, and when sufficiently heated, the piece must be removed to the cooling liquid with as little exposure to the air as possible. If the contents of the box be thrown, with the steel, into oil, so as completely to exclude the air, it will preserve its polish, and brightness, unchanged.

All articles of steel are more or less liable to become warped, by rapid cooling, from the unequal contraction of the parts, and many, from the same cause, require the greatest dexterity and skill, to prevent them from breaking in pieces during the operation.

Whenever, therefore, the nature of the case admits the use of oil, as a cooling medium, it is safer than water, being much less rapid in its operation. It is obvious, however, that as large masses of steel can with difficulty be cooled, even in water, within the hardening limit of time, only small articles, such as springs, thin blades, &c. can be hardened, at all, in oil. It is sometimes pretended that oil imparts a degree of toughness to steel hardened in it, just as it would to a bit of horn, or leather, by penetrating its pores; and I believe the patent obtained for the use of it, in hardening a certain *celebrated patent oil-hardened-spring truss*, was grounded upon such a supposition.

The danger of breaking increases with the *thickness* of the piece, whatever may be its form; and that form is least liable to break, in which there is the greatest freedom of motion, or in which a simultaneous contraction can be effected in all the parts.

In hardening a roller, say two or three inches in diameter, and about the same in length, the first tendency of the contraction of the surface is to separate it. But this strain being equally divided around the circumference, and the metal being in a yielding state, the only effect in general, is, to enlarge the surface beyond its original dimensions. The surface thus enlarged, immediately becomes hard and fixed; so that the subsequent cooling of the centre, reverses the strain upon the surface, tending to compress or shorten it, and that, to such a degree, that a segment is often thrown off with great violence, or, when the outer portion has sufficient strength to resist the contracting force of the centre, that portion in its turn tends to separate, being prevented by the outer part, (to which it adheres) from returning to its original dimensions. In this case, a separation at the centre is inevitable, unless a part of the heat be allowed to remain, until the surface be relaxed by tempering, after which it may be suffered to cool. When a rent commences at the centre, the parts generally separate with such force, as to sunder the mass, accompanied by a loud report.

It sometimes happens in the breaking of dies, rollers, &c. (in which the tempering has been omitted) that the effect does not take place until several hours, and even days, after they have been hardened.

Steel is allowed by authors to expand about $\frac{1}{8}$th of an inch to the foot, in heating to the hardening point, and to contract, on cooling, about $\frac{2}{3}$ds of what it had been expanded, provided the hardening effect takes place; otherwise it returns nearly to its original size. Accordingly, I have been in the habit of making allowance for this enlargement, which is generally found to take place, in a greater or less degree, and for many years held the opinion that it was a necessary consequence of hardening steel, and that this effect *ought* to take place, just in proportion to the degree of hardness produced.

With this doctrine, however, facts are at variance, and I believe, that the circumstance, above alluded to, as the cause of breaking,

may also explain most satisfactorily, the phenomenon in question, (to wit) that of hardening the exterior, before it can possibly be permitted to contract to its proper size, because of the expanded mass within.

I have found in a number of cases of thin hollow cylinders, or flattened rings, where there was the best chance of thorough, and almost instantaneous cooling, and, of course, of producing the greatest degree of hardness, that no enlargement was perceptible.

Particular care should be observed, in the act of cooling, not to suffer any intermission, in any part, as is often done by moving the piece backward and forward, too briskly, in the water, alternately cooling, and exposing to a vacuum, the opposite sides; for a part thus exposed, after moving rapidly against the current, until fairly hardened, might be let down, or tempered, as it is called, by the heat rushing from the centre, toward the side exposed to the vacuum, without being sufficiently re-heated to prepare it for hardening at the return of the current of water. In this way, soft places are often produced, which will erroneously be attributed to uneven steel, want of sufficient heat, &c.

By dipping the end of a small bar, (heated to several inches in length,) and keeping it quite still, until it is hardened nearly to the surface of the water, (which should be very cold,) and then raising it quickly, an eighth of an inch, or more, according to the size of the bar, a portion of what was hardened, will be softened by the heated part above;—as soon as this is perceived, let the bar be again sunk into the water, to where it remains of a hardening heat, which will be perhaps half of an inch lower than before, another portion of about $\frac{3}{8}$ths of an inch will thus be hardened; let the bar be again withdrawn a small distance, as before, repeating the operation, until there no longer remains sufficient heat in the bar for hardening; the result will be, a number of successive hard and soft rings.

While testing the strength of different kinds of steel, by repeatedly hardening each kind, until a fracture should take place, I was somewhat surprised to find the pieces, which were small, (such for example, as were an inch square, and $\frac{3}{8}$, or $\frac{1}{2}$ an inch thick,) considerably swollen, after three or four times hardening, and that every hardening increased their convexity, until they actually burst the surface, in the middle of one of the faces. Repeating the experiment, with a piece prepared perfectly flat, I found the first, second, third, and fourth time, of hardening each, to produce a small additional elevation of the surface. On the fourth attempt, the piece cracked.

I have seen a thin piece of steel very beautifully hardened, by chilling in its passage through a rolling mill; this piece afterwards exhibited in its fracture an exceedingly fine grain, a probable consequence of its being hardened under immense pressure.

Small drills, and other articles of the thickness of a small needle, may be cooled, with sufficient rapidity to become hard, by moving them briskly through the air.

Water, to be active, in cooling, should be perfectly free from soap,

—a small portion of that substance, will cause the time of cooling to be extended beyond the hardening limit, especially if the piece of steel be not very small.

The grain of steel, though finer when hard than when soft, becomes still finer, the lower the temper be drawn, until about a medium between hard and soft, when the fineness begins to decrease.

Cast-iron is capable of being hardened in the same manner as steel, except the kind which is already hardened at the time of casting. This kind possesses a superior degree of hardness, which differs materially from that obtained in the manner of hardening steel. It takes place in passing from the fluid to the solid state, and can only be changed by re-melting. As soon as time will permit, I intend offering some remarks on hard and soft cast-iron.

The most satisfactory theory of hardening steel, which also applies to cast-iron, is one suggested by Mr. William Mason, of this place. He supposes, that at the hardening heat, the component parts of steel exist in a state of perfect chemical union, and that if time be allowed in cooling, that union is dissolved, or changed to a simple mechanical mixture. This he conceives to be supported by the following experiment: melt together certain proportions of zinc and quicksilver, and pour one part of the amalgam into water, and the other into a wooden or paper mould; that which is poured into water being suddenly chilled, retains its chemical union, and becomes of the consistence of paste; the other separates, the zinc forming a solid cellular body, holding the quicksilver in very minute globules, in its interstices.

Very respectfully,

RUFUS TYLER.

Report of the Committee on Inventions, on WINAN'S *Rail-way Carriage, referred to them by the Franklin Institute, at their monthly meeting for discussion of Mechanic and Scientific Questions, held April* 23, 1829, *in compliance with the request of* JOHN L. SULLIVAN, Esq.

The committee on inventions, to whom was referred the consideration of Winan's Rail-road Car, beg leave to report:—

THAT they have attentively considered the subject assigned to them, both with reference to the model before them, and to the description contained in the Journal of the Institute. They have, likewise, duly weighed the remarks of Mr. Sullivan, contained in a letter which accompanied the model, and which invited the closest scrutiny into the merits and defects of the principles of construction, and of the mode in which it is proposed to apply them to practice.

The resistances to be overcome in drawing a load over a common turnpike, or other road, arise from several causes: *first*, from the inequalities of the road itself, which allow the wheels to sink at one moment into cavities, and require them, and of course the load also, at another, to rise over prominences. *Secondly*, from the *friction*

of the axles in the naves of their wheels. *Third*, from the adhesion of the wheels to the materials of the road. *Fourth*, from the air in which the vehicle and all connected with it must ever be placed. To these causes of resistance we may add that of the inertia of the carriage and its load when commencing its motion, and finally, the inclination of the plane of the road, which will be in concurrence with, or in opposition to, the above mentioned causes, according as the carriage is ascending or descending, and of course, on a horizontal plane, is equal to zero. The primary object of all rail-roads, is, to conquer the first mentioned cause of resistance, namely, the inequalities of surface. To do this completely, the materials composing the rails, and the wheels which pass over them, must be *perfectly hard, smooth, inflexible, and free from the most minute particles of foreign matter.* If this were practically, as well as theoretically, characteristic of the rail-way, there would be no question about the amount of the second resistance, because the wheels, instead of turning on their axles, would then slide on the rails without revolving at all, as they are sometimes observed to do upon very smooth ice, and this, too, however small, might be the friction at the naves of the wheels, because the friction at the periphery would be still less, that is, absolutely *nothing*. The car would, in fact, become a sledge. But since the imperfection of materials, and the unavoidable inaccuracy of all structures formed by human art, forbid us to expect such a rail-way will ever exist, it becomes necessary to compute the amount of the second resistance, and, if possible, to devise means to reduce or to overcome it. The friction is *reduced* by making the nave and its axle as smooth as possible, by forming the two of different metals, by reducing the diameter of the axle as far as may be consistent with proper strength, and, finally, by the lubrification of the rubbing surfaces with such oily substances as are found effectual for this purpose. By these expedients, and by duly defending the interior of the naves from dust and from water, it is found that in practice the friction due to the axles may be reduced to about $\frac{1}{177}$ of the load.

With this reduction the horse may, without difficulty, draw a load of 8 or 9 tons over a perfectly level rail-way. With the same reduction an inclination of 30 $\frac{6}{35}$ feet per mile would, on a descending plane, be sufficient to overcome the friction and cause the car to descend by its own gravity. The irregularities of the rails and the slight obstructions from foreign matter, would be the same in all cases, and increase the necessary inclination. But in addition to the reduction of friction by the means already mentioned, there may be an application of the mechanical powers to *overcome* the remaining resistance, wherever the purpose to be accomplished will warrant an additional expense in the construction of the car; and where the additional machinery will not, on account either of its weight or complication, prove more detrimental than useful.

One of the most obvious expedients to augment the power of the wheel to overcome friction, would be, to increase its diameter, while the diameter of the axle remained constant, because as the friction

is proportionate to the weight, it would, for a given load, remain the same on an axis of given size and materials, however high the wheel should be on which that load might rest. But if the radius of the wheel be increased, the length of the arm of lever which overcomes this constant resistance is proportionally increased. Those who prefer the principle of virtual velocities for explaining mechanical powers, may consider, that with a wheel of double diameter, the load will be conveyed over a double space on the rail, while the force applied is overcoming that amount of friction which results from a single revolution of the wheel on its axle. This mode of overcoming friction has, however, the disadvantage of carrying the axles too high, and of exposing them to the injurious effects of a powerful lateral pressure when the two rails are not precisely of the same height. The changes of form in the wheel itself, would likewise require attention when its height should be greatly augmented. But it is not necessary to dwell on the defects of the high wheeled carriage. The committee have only referred to it as one of the expedients by which it has been attempted to overcome, in part, the friction on the axle.

The description of Winans' rail-road carriage, contained in the Journal of the Institute for April last, is so full as to require but little explanation from your committee. The mode of overcoming the friction of the axle, by causing the ends of it to revolve within the rims of friction wheels whose axes are below that of the travelling wheels, is certainly a very ingenious device.

It is not perceived by your committee, that the mere circumstance that the first and second orders of the lever are combined in the forms of the wheels of this carriage, is of any peculiar advantage in overcoming friction, since the principle of action and amount of power gained by the two orders is precisely the same. All the superiority which this circumstance imparts to the car before us, arises, therefore, from the convenient arrangement of the parts. It is a decided advantage in point of firmness and compactness of structure, that the friction wheels require no additional fixtures with which to attach them to the load frame, except such as constitute in fact a part of that frame itself.

The liability of common rail-way carriages to heat the gudgeons when moving with great speed, is a practical difficulty, which appears to be entirely removed by transferring the rubbing surface from the axes of the *primary* to those of the *secondary* wheels. The latter will always move so slowly as to preclude the idea of much increase of temperature from friction.

It will be observed, that the load now rests on eight bearings instead of four, the number found in every four-wheel carriage of the simplest construction. This allows the gudgeons of the *secondary* wheels to be less in diameter to support a given load, than those of the *primary*. A single revolution of the *secondary* wheel, will, therefore, present a less number of rubbing points to any part of the bearing, than would a revolution of the primary wheel, whose axis is of double diameter to that of the former. And the leverage is greater where the diameter of the gudgeon is less, so that if the strength and

other properties of materials allowed a very great diminution of the axle, the smaller it could be made, the better.

The friction is, doubtless, as stated in the description above referred to, nearly proportional to the weight; but when the weight is constant, and the motion of the rubbing surfaces uniform for each case, the *sum of all the resistances* due to friction is proportional to the number of units of rubbing surface brought into contact during a given time. If this be true, it is of great importance to form the pivots of the secondary wheels in such a manner as to rub on their bearings through the least possible space, while the carriage passes over the greatest possible space on the road.

The model performs in a manner sufficiently decisive of the advantage which the principle of its construction has over that of the simple car in overcoming friction; but your committee would hesitate to receive the performance of this model as a certain indication of what may be expected from the machine of full size on a common rail-way.

Nothing but actual experiment on a large scale will fully develop the precise amount of advantage of a machine of this nature, because it is not possible to foresee all the circumstances which will attend its construction and use. If confined to a straight, level, road, there can be no doubt that the power of the mover would be greatly increased by the addition of friction wheels. The same may be said where the carriage is employed solely in transporting loads *down* an inclined plane. But in conveying loads *up* an inclined plane, the additional weight arising from the friction wheels would increase the gravitating power of the load. With the common cars, as perfected in England, the horse could draw up a plane inclined $30\frac{6}{55}$ feet per mile, only one-half as much as he could draw on a level; because, as before stated, the effect of gravity would there be just equal to friction, computing the latter at $\frac{1}{17\frac{1}{3}}$ of the load. Now, if the car of Mr. Winans enables the horse to draw 56 tons on a perfectly smooth and level road, where friction only is to be considered, it would require the strength of about $7\frac{1}{2}$ horses to convey the same load up the inclined plane just mentioned.

This would seem to decide in favour of confining the use of this car, if adopted at all, to level roads, or to those on which the transportation is descending, or at least to those on which stationary power is employed in surmounting elevations.

As the invention has been presented with a request that its merits and defects may be closely scrutinized, your committee have thought proper to present some of those points in which it seems likely that this carriage may be found inconvenient, or defective, in its practical application.

The first of these arises from the shortness of the axes of the secondary wheels, compared with the diameters of those wheels themselves, by which they will be liable to act as bent levers, and twist the side pieces of the frames out of their natural positions, or to wear, unequally, the two bearings of those axes.

Secondly, the latter effect will, it should seem, be increased by

the swagging of the load from side to side, in consequence of the arrangement by which the ends of the axes of the primary wheels act against the flanches of the secondary. Now they always act *outward*, and on one wheel at a time for each axis; consequently, there can be no restoring tendency, by which, when a friction wheel is pushed out of its vertical position, or its inner bearing is worn more than the other, the evil will be likely to be corrected.

Third. The imperfection of castings and other workmanship, may possibly allow the friction wheels to be worn in one or more places on the inside of each rim, to such a degree, as to allow the gudgeon to turn in the hollow part, as in a common bearing, and thus to prevent the secondary wheel from revolving. Should this be the case, the friction would, for that gudgeon, be reduced to that of the simple car.

Fourth. The friction wheels must be made heavier than if the pressure of the primary axles were applied to the *outside* of their rims, because, in the latter case, the arched form of the part to which the pressure is applied, would conspire with the cohesion of materials, to prevent the fracture of the rim, but the cohesion of parts must alone sustain the pressure in the case of the car at present under consideration.

Finally, as the axes of the primary wheels do not constantly preserve their parallelism with those of the secondary, the gudgeons of the former may be irregularly worn, in consequence of the obliquity which they may assume to the cylindrical surface of the interior of the friction wheel, and the same circumstance also allowing the whole pressure of a gudgeon to be occasionally brought upon the edge of the rim of a friction wheel, this part must be made strong enough to sustain the whole weight.

In conclusion, your committee would express a wish to see a carriage on this construction of full size put into operation, believing, that on levels and gradual descents, at least, it may be found eminently serviceable, and not doubting, that the same ingenuity which devised the construction, would supply the defects which we have pointed out, should they prove to exist, or any others which experience might demonstrate to belong to the peculiar construction now exhibited.

All which is respectfully submitted.

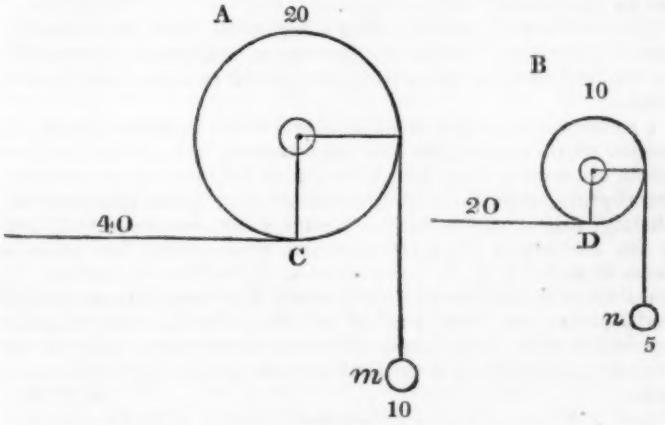
FOR THE FRANKLIN INSTITUTE.

On the force of Bodies in Motion, intended as an answer to some remarks on that subject, in the last number of this Journal.

Proposition 1*st.* If a double velocity in the quantity of water gives a double force, then it will raise, when applied to mill wheels, double the weight, to double the height, in the same time.

Suppose the diameters of the wheels A and B, to be as 2 to 1, and the same quantity of water to strike their circumferences in the same time, the large wheel with a velocity 40, and the small one with a velocity 20. Suppose also that the circumference of the large

wheel moves with a velocity 20, and that of the small wheel with a velocity 10; then will the water strike the large wheel with a velocity 20, and the small wheel with the velocity 10. Suppose now the forces to be as the velocities, there will be a double force applied to the circumference of the large wheel; consequently it will balance a weight *m*, double the weight *n*; but the weight *m* being hung at the circumference of the large wheel, will move upwards with a velocity 20, and the weight *n* with a velocity 10; therefore, a double weight is raised to a double distance in the same time.



Proposition 2nd. If a double velocity in the same quantity of water gives a quadruple force, then it will raise, when applied to mill wheels, four times the weight, to double the height, in the same time.

For in the above construction, according to the latter supposition, the circumference of the wheel at C, would be pressed with a force four times as great as the circumference of the wheel at D, and therefore, the weight at *m*, must be four times as great as the weight at *n*, and the velocity at *m*, is twice as great as the velocity at *n*; therefore, four times the weight will be raised to double the height in the same time.

The demonstrations of these two propositions, may serve as an answer to a very ingenious paper, which appeared in the Journal of the Institute for August last, in which the author endeavours to prove, that the forces of bodies in motion are as the squares of their velocities.

For it being known by experiment, that the effect of undershot wheels is conformable to the first proposition demonstrated above, and not to the second, it follows, that the first supposition is the true one, and not the second.

The following experiment, which is laid down in *the books*, I consider as direct proof, that the momentum of bodies is as their velocity, and not as the square of their velocity, as the writer above mentioned endeavours to prove.

I took two balls of soft clay, one double the weight of the other, and hung them by strings, of equal length, to a nail in the wall. I then drew them in opposite directions from the *line of direction*, the smallest to double the distance of the other, and let them fall towards each other; when they met, all motion ceased; proving that the double velocity of the smaller body, which it is known it acquires, in the present circumstances, exactly counterbalances the double weight of the other body, with half the velocity.

This principle being established, it is easy to demonstrate the following proposition.

If a body is made to slide along a horizontal plane, by a force terminating at a single stroke, the quantity of momentum destroyed by friction, will be equal, in equal times, and not in equal spaces passed over.

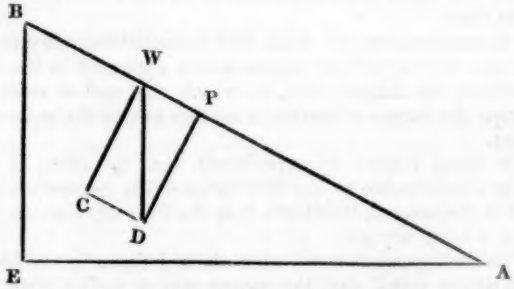
I performed a number of experiments in the presence of the gentleman, whose opinions are here controverted, which I need not now detail, all showing that the spaces passed over by a body on a horizontal plane, when the body comes to rest, are as the squares of the velocity; that is, with a double velocity, a body will move four times as far, and with a triple velocity, nine times as far, &c. before it comes to rest. Now, it is well known, that with such motions, the times which the bodies will move before they come to rest on horizontal planes, are directly as the velocities; that is, equal velocities are destroyed in equal times; therefore, the momenta being as the velocities, the quantity of momentum destroyed in equal times is the same.

J. P. E.

FOR THE FRANKLIN INSTITUTE.

A Reply to the Query, does a body descending on an Inclined Plane with an accelerated motion, press the plane with the same force through every portion of its length?

Proposition.—A heavy body in passing down an inclined plane with an accelerated motion, exerts a uniform pressure on all parts of that plane.



For suppose A, B, an inclined plane, and W, a heavy body resting on any part thereof, and (as lines may be taken as the representa-

tives of forces,) let us assume the straight line, W, D, to be the force of gravity, or weight of the mass W.

Then let us resolve this gravitating force, into two equivalent forces, W, C, perpendicular to, and W, P, in the direction of the plane A, B. It is evident that the part of the weight represented by W, C, will be constantly supported by the plane, and must remain constant, whatever be the velocity, since the force W, P, which alone acts in giving the body motion down the plane, is in the direction of the plane, and cannot change W, C. Q. E. D.

Remarks by the Editor.—In applying the mathematics to the explanation of physical truths, erroneous deductions are frequently made, from the neglect of some of those circumstances in the phenomenon to be elucidated, which influence the result; and such we believe is the case in the foregoing solution.

A body rolling down a plane has its motion accelerated in the same ratio as when falling through free space, and passes, therefore, with increased rapidity, as it approaches the bottom of the plane. Suppose the body, W, to be projected with great rapidity from B to A; let it, for example, be fired from a gun, precisely in the direction of the plane, and just touching it, would it in that case press upon the plane with the same force as when at rest upon it? Now the effect must be the same, from whatever source the motion is derived, provided its velocity be equal. A rapid motion in the descending body resembles a centrifugal force, and operates in the same way in counteracting the effect of gravity. Were the orbit of the earth a solid ring, the earth would revolve upon it without pressing it; but decrease its velocity, or centrifugal force, and it would then press upon the ring: the cases appear analogous.

Bigelow's Elements of Technology.

This work, which has recently made its appearance in one volume, octavo, of 506 pages, from the press of Messrs. Hilliard, Gray, Little, and Wilkins, at Boston, seems eminently deserving of public patronage, as well from the interesting nature of its subject, as from the happy manner in which it is treated. Indeed, the character of its author, and the responsible station in which he was placed, as Rumford Professor, in Harvard University, together with the abundant materials, models, and works on practical science, placed at his command, are a sufficient guarantee for the value of his book. All who have enjoyed the benefits of instruction in that institution for the last ten years, must recollect, with peculiar satisfaction, their attendance on Dr. Bigelow's lectures. They will doubtless recognise as one of the sources of their pleasure, the consciousness, that what they were learning, was not only an accumulation of most valuable facts and principles, but a fund of knowledge, immediately applicable to the wants and the welfare of mankind; and at the same time, demonstrative of the power and resources of the human understanding.

The book before us, contains the substance of those lectures; and to such as know their character, no other recommendation of this volume will be required. It may, however, be proper to state, that the work is not, as some might be led from its title to imagine, a mere *technological vocabulary*, containing the definitions of *words* used in the arts; but that the *things* to which such terms are applied, are the principal objects of Dr. Bigelow's discussion, and that the definition of terms, is incidental only to his main purpose. Though every thing is presented in language, as clear as the English tongue can furnish, yet there is no pedantic display of verbal exactness, so often found in elementary books. The subjects are treated with sufficient minuteness, to aid the student in his elementary inquiries; but not with such particularity of detail, as to fatigue the mind, or to create a supposition that the subject is exhausted, and that more extended treatises must not be afterwards consulted, in order to understand the whole of any one branch of art.

The work is divided into twenty-one chapters, each embracing some great department of the useful arts. The subjects are, the materials used in the arts; their form, condition, and strength; the arts of writing and printing; of designing and painting; of engraving and lithography; of sculpture, modelling and casting; of architecture and building; of heating and ventilation; of illumination; locomotion; elements of machinery; moving forces used in the arts; conveying water; dividing and uniting solid bodies; combining flexible fibres; horology; metallurgy; communicating and modifying colour; vitrification; induration by heat, and the preservation of organic substances.

At the end of each chapter, is a list of such authors and works of value, as treat upon the several subjects. Among these, we confess ourselves gratified at seeing the title of our own journal several times mentioned; because it affords evidence, that our humble labours in this vocation have not been wholly unavailing, towards the promotion of interests so dear to every patriotic mind,—the cultivation and diffusion of useful, practical science.

The plates at the end of the volume are neatly executed. A copious index is added, and must be found extremely serviceable. The mechanical execution of the work does credit to the publishers, and will doubtless contribute to reward their undertaking.

J.